



Transportation and Public Works

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# STANDARD SPECIFICATION

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Highway Construction and Maintenance



February 1, 1997





## Enquiries...

Seven Standard Specification review teams have been formed with the mandate of reviewing and revising existing Standard Specifications and developing new ones:

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Any questions regarding the **review process** and **content** or **revisions** of the Standard Specifications can be directed to any one of the team leaders.

Any questions regarding interpretation of the Standard Specifications for a particular contract should be directed to the Engineer in charge of administering the contract.

The Standard Specification is available for purchase at the Nova Scotia Government Bookstore at 1700 Granville St., Halifax, N.S.

## Revisions to Standard Specifications:

The Nova Scotia Department of Transportation and Public Works performs an annual review of its Standard Specifications for Highway Construction and Maintenance. As deemed necessary specifications may be revised or new specifications developed.

**It is the responsibility of all holders of the Standard Specification book to obtain new or revised specifications and insert them in the book.** The following page has been included for the convenience of book holders to record the insertion of revisions to the book.

Any new or revised specifications will be available at the Nova Scotia Government Bookstore on February 1st of each year. The Government Bookstore is located at 1700 Granville St., Halifax, N.S.

## Revisions

### Standard Specification

### Record of Revisions:

[illegible]

## Revisions

### Standard Specification

### Record of Revisions:

[illegible]

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## Division 1 General Requirements and Covenants

## Section 1 Definition of Terms

## SECTION 1 - DEFINITION OF TERMS

When in any part of the Contract, the following words or expressions or pronouns used in their stead are used, the intent and meaning shall be interpreted as follows:

**ADDENDUM.** A supplement to the tender forms as originally issued or printed, covering additions, corrections or changes in the bidding conditions for the advertised work, that may be issued by the Department to prospective bidders prior to the bid closing time.

**ADDITIONAL WORK.** Additional work means any work or service, which is beyond the scope of the work contemplated by the Contract Documents.

**BASE.** Granular materials placed immediately below the pavement.

**BIDDER.** Any individual, firm or corporation submitting a bid for the work contemplated.

**BID.** An offer submitted in response to an invitation to bid.

**BID CLOSING TIME.** The time up to which bids will be accepted and beyond which bids will be rejected.

**BIDDING PERIOD.** A time provided to prospective bidders to assemble and submit their bid. Further defined as the time period between the Invitation to Bid and the Bid Closing Time.

**BID SECURITY.** A promise to pay to the contracting authority its costs of accepting another bid, up to a specified limit, if the bidder is awarded the bid and fails to enter into the required contract.

**BRIDGE.** A structure of a span of more than 3 m measured between the abutments and along the centre line of the roadway, and also including multiple spans where the individual spans are more than 3 m. The width of bridges is the distance between the inside faces of curbs (at the top of same) measured at right angles to the centre line of the roadway.

**CERTIFICATE OF FINAL ESTIMATE.** A report to the Minister by the Engineer that the Contractor has completed the work, and a recommendation that the Final Estimate be paid.

**CERTIFICATE OF RECOGNITION.** A certificate awarded to firms by the Nova Scotia Construction Safety Association and the Nova Scotia Department of Labour, who have completed the training requirements, fully implemented a loss control program, and successfully participated in the audit process.

**CITY.** The incorporated City in which the work is being carried out.

**COMPETENT BID.** The low responsive bid submitted by a responsible Contractor or supplier is deemed to be the lowest competent bid.

**CONTRACT.** The Agreement covering the performance of the work and the furnishing of materials in the construction of same, which shall include the advertisement, the instructions to Bidders, the Tender, the Province of Nova Scotia Department of Transportation and Public Works Standard Specifications - Highway Construction and Maintenance dated February 1, 1997, Special Provisions, the Specific Agreement, Release from All Liabilities and any Supplemental agreements and all plans pertaining to the work.

**CONTRACTOR.** The Party of the First Part to the Contract acting directly or through his/her agents or employees and who is primarily liable for the acceptable performance of the work for which he/she has contracted and also for the payment of all legal debts pertaining to the work.

In order to avoid cumbersome and confusing repetition of expressions in this Contract, whenever it is provided that anything is, or is to be, or to be done, if, or as, or when, or where, "contemplated", "required", "directed", "deemed necessary", "permitted", "suspected", "approved", "acceptable", "unacceptable", "suitable", "unsuitable", "satisfactory", "unsatisfactory", or "sufficient", such expressions shall have the same force as if followed by the words "by the Engineer" or "to the Engineer" as the case may be.

**COUNTY.** The County in which the work is being carried out.

**CULVERT.** Any structure, not classified as a bridge, which provides an opening under the roadway.

**DEPARTMENT, DOT&PW AND DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS.** The Department of Transportation and Public Works of the Province of Nova Scotia.

**DEPUTY MINISTER.** The Deputy Minister of Transportation and Public Works of the Province of Nova Scotia.

**ENGINEER.** The Executive Director District Operations of the Department of Transportation and Public Works acting directly or through an assistant or

**Division 1 General Requirements and Covenants****Section 1 Definition of Terms**

representatives, duly authorized by the Executive Director District Operations, and only within the scope of the particular duties assigned to them or within the scope of the authority vested in them.

**EXTRA WORK.** Any work or service, the performance of which is beyond the scope of the contract and for which no quantity and/or price was included in the contract, which is determined by the Engineer to be necessary or desirable to complete the contract.

**HIGHWAYS.** The whole right-of-way which is reserved for use in constructing the roadway and its appurtenances.

**INSPECTOR.** The authorized assistant to the Engineer assigned to make inspection of work performed or being performed and materials furnished or being furnished.

**IRREVOCABLE STANDBY LETTER OF CREDIT.** A written document issued by a Canadian Chartered Bank in a form satisfactory to the Department and used as a security deposit for the contract. The letter of credit shall be unconditional and subject to the uniform customs and practices for documentary credits (1993 Revision) International Chamber of Commerce (Publication No. 500). The bank issuing the letter of credit is obligated to make payment provided the beneficiary (Department) produces a sight draft and a written demand for payment.

**LIQUIDATED DAMAGES.** The charge assessed against the Contractor by the Department because of failure of the Contractor to complete the contract within the contract time or by the contract completion date.

**MATERIALS.** Any substances specified for use in the construction of the project and its appurtenances.

**MINISTER.** The Honourable Minister of Transportation and Public Works of the Province of Nova Scotia.

**MUNICIPALITY.** The county or district, under the jurisdiction of a Municipal council, in which the work is being carried out.

**PLANS.** Any Official Plans, Profiles, typical Cross-sections, Working Drawings, Supplemental Drawings, or exact reproductions thereof, approved by the Engineer, which show the location, character, dimensions and details of the work to be done, and which are to be considered as a part of the Contract.

**PROJECT.** All of the work described in the contract.

**PROVINCE.** The Province of Nova Scotia.

**QUALITY ASSURANCE (QA).** All those planned and systematic actions required by the owner or owner's representative, to provide adequate confidence that a product or service will satisfy given requirements for quality. In contractual situations, QA serves to provide confidence in the contractor and/or supplier.

**QUALITY CONTROL (QC).** The sum total of activities performed by the seller (producer, manufacturer, and/or Contractor) to make sure that a product meets contract specification requirements. Within the context of highway construction this includes materials handling and construction procedures, calibration and maintenance of equipment, production process control, and any sampling, testing, and inspection that is done for these purposes.

**ROADBED.** That portion of the roadway extending from shoulder line to shoulder line, in other words, the sub-grade and shoulders considered as a unit.

**ROADWAY.** The portion of the highway included between the outside lines of gutters, or side ditches, including all the appertaining structures, and all slopes, ditches, channels, waterways, etc., necessary for proper drainage and protection.

**SCHEDULE OF WORK.** The Schedule of Work is defined as a schematic representation of the length of time required to complete individual items of work, and how it relates to other items of work in the contract, all in accordance with the completion date of the contract.

**SECURITY DEPOSIT.** The Security designated in the Tender to be furnished by the Bidder as a guaranty of good faith to enter into a Contract with the Department and also covering the performance of the work and warranty period if the work contemplated is awarded to said bidder. Said Security shall be retained by the Department as a guaranty of good faith and ability on the part of the Contractor to execute the work in accordance with the terms of the Contract.

**SHOULDER.** The portion of the roadway contiguous with the travelled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

**SLOPES.** The inclined graded areas extending from the shoulders to the natural undisturbed surface of the ground.

**SPECIAL PROVISIONS.** Additions and/or revisions to the Standard Specifications applicable to an individual contract.

**Division 1 General Requirements and Covenants****Section 1 Definition of Terms**

**SPECIFICATIONS.** The directions, provisions, and requirements described in the Province of Nova Scotia Department of Transportation and Public Works Standard Specifications dated February 1, 1997, supplemented by such Special Provisions as may be necessary, pertaining to the method and manner of performing the work, or to quantities of materials to be furnished under the Contract.

**SUBBASE.** Granular materials placed immediately below the base and above the subgrade.

**SUBGRADE.** That portion of the roadbed upon which the subbase (or base in the case subbase gravels are not used) is to be placed.

**SUPPLEMENTAL AGREEMENTS.** Written agreements executed by the Contractor, and by the Engineer, covering alterations necessary to the project as hereinafter provided.

**TENDER.** The offer of the Bidder for the work when made out and submitted on the prescribed Tender Form properly signed and guaranteed.

**TENDER FORM.** All approved forms on which the Department requires formal bids to be prepared and submitted for the work as detailed in the specifications.

**TOWN.** The incorporated Town in which the work is being carried out.

**THE WORK.** The furnishing of products, material, labour, equipment and other incidentals necessary or convenient to successful project completion, plus the fulfilment of all duties and obligations required and imposed by the contract.

**TRAFFIC CONTROL MANUAL.** NS Department of Transportation & Communications (Public Works) Temporary Workplace Traffic Control Manual.

**UNFORESEEN WORK.** Unforeseen work is work that cannot be covered by any of the various items or combination of items for which there is a bid price. The Engineer may require the Contractor to furnish material and do work not provided for in the tender as may be found necessary or pertinent for the proper completion of the work embraced in the contract.

**VALUE ENGINEERING ALTERNATE (VEA).** An alternate design or modification(s) to a tendered design where a construction cost saving in excess of \$50,000 can be achieved, without compromising the integrity and quality of the project, prepared and submitted as detailed in the specifications.





## Division 1 General Requirements and Covenants

## Section 2 Instructions to Bidders

**SECTION 2 - INSTRUCTIONS TO BIDDERS**

**1.0 CONTENTS OF TENDER.** The Bidder will be furnished by the Department with a Tender Form (See Appendix A) which will state the location and direction of the work to be constructed, and which will show the approximate estimate of the various quantities of the work to be performed and materials to be furnished. The time frame and date on which the work must be completed shall also be provided. All papers bound with or attached to the Tender Forms are a necessary part thereof and must not be detached. All Special Provisions which vary from or are not contained in the Standard Specifications, dated February 1, 1997, will be clipped together and attached to the Tender Form.

**2.0 INTERPRETATION OF APPROXIMATE ESTIMATE OF QUANTITIES.** The Bidder's attention is called to the fact that the estimate of the quantities of work to be done and materials to be furnished under these specifications as shown on the Tender Form is approximate, and is given only as a basis of calculation upon which the award of the Contract is to be made. The Department does not assume any responsibility that the quantities shall obtain strictly in the work nor shall the Contractor plead misunderstanding or deception because of such estimate of quantities or of the character, location or other conditions pertaining thereto. The Department reserves the right to increase, decrease or omit all or any of the quantities of work shown in the Tender Form, if the Department may deem it necessary.

**3.0 EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF THE WORK.** Bidders shall carefully examine the Instructions to Bidders, Plans, Specifications, Special Provisions and site of the Proposed Work in order to satisfy themselves by examination as to all local conditions affecting the Contract and as to the detailed requirements of construction.

**4.0 PREPARATION OF TENDER**

**4.1 Tender Forms.** The Bidder must submit his Tender on the forms furnished by the Department. The blank spaces in the Tender Forms must be filled in correctly, where indicated, for each and every item for which a quantity is given, and the Bidder must state the prices (written in ink both in words and numerals) for which he proposes to do each item of the work contemplated. The bidder shall sign his Tender correctly. If the Tender is made out by an individual his name and Post Office address must be shown, if made by a firm or partnership the name and Post Office address of each member of the firm or partnership must be shown and if made out by a corporation the person signing the Tender must show the name of the Province

under the laws of which the corporation was incorporated and the names, titles, and business addresses of the President, Secretary, and Treasurer.

**4.2 Addendums.** The Bidder must submit, as part of his tender, all addendums issued during the bidding period by the Department covering additions, corrections or changes in the bidding conditions for the advertised work. The bidder shall make all revisions to the Tender Documents as instructed in the aforementioned addendum and include a signed copy with his tender submission.

When an addendum is issued, the closing time shall, where necessary, be adjusted to reasonably allow bidders to receive the addendum and adequately consider, prepare and submit their bids, taking into account the impact of the addendum.

**4.3 Additional Documents.** Where instructed in these specifications, the Bidder shall submit any and all additional certificates, supplements, letters, plans and other information with their Tender Submission. They shall be attached to the Tender Forms and signed as directed.

**5.0 POST BID SUBMISSIONS.** To be eligible to be awarded any Department highway construction or maintenance contract to which these specifications apply, the bidder must provide within forty-eight (48) hours of request the following submissions: a Certificate of Recognition or Letter of Good Standing issued jointly by the Nova Scotia Department of Labour and an occupational health and safety organization approved by the Nova Scotia Department of Labour (such as the Nova Scotia Construction Safety Association), or a valid Letter of Good Standing from an occupational health and safety organization approved by the Nova Scotia Department of Transportation and Public Works indicating that the Contractor is in the process of qualifying for the Certificate of Recognition. An example of this letter is included in Appendix 'A' of these specifications. 

The bidder must provide within forty-eight (48) hours of request, evidence of an account with the Workers' Compensation Board, coverage under the Workers' Compensation Act, revised statutes of Nova Scotia and a Clearance Certificate indicating that the bidder is in good standing. 

**6.0 TAXES**

**6.1 Harmonized Sales Tax.** The Province is not exempt for Harmonized Sales Tax (HST) purposes. As a result, the aggregate amount of tender for



**Division 1 General Requirements and Covenants****Section 2 Instructions to Bidders**

Department contracts is subject to HST, however, prices submitted shall not include HST.

The HST payable by the Department will be added as a separate item during Department processing of progress payments and, therefore, HST will not appear as a cost in the aggregate amount of tender.

Bidders are advised that they are eligible to claim an Input Tax Credit (ITC) for a portion of the HST paid in relation to the contract to the requirements of the Government of Canada.

**7.0 RECEIVING TENDERS.** As instructed by Public Tender Office.

**8.0 REJECTION OF TENDER.** Tenders will be rejected if they show any omissions, alterations of forms, additions not called for, conditional or alternate bids, or irregularities of any kind or if they contain a clause in which the Bidders reserves the right to accept or reject a Contract awarded to him. Tenders in which the prices are obviously unbalanced may be rejected. The right to reject any or all Tenders is reserved by the Minister and the lowest or any Tender will not of necessity be accepted.

**9.0 SECURITY.** Tenders will be rejected unless accompanied by a security deposit of a specified amount. This deposit shall consist of a certified cheque or irrevocable Standby Letter of Credit in a form satisfactory to the Department for a specified amount made payable to the Department of Transportation and Public Works, Province of Nova Scotia, drawn upon a Canadian Chartered Bank and marked accepted by the financial institution upon which it is drawn. It will be forfeited to the Department, if the Bidder neglects or refuses to enter into a Contract when called upon to do so, or if, after entering into a Contract, he fails to proceed with and complete the work satisfactorily, according to the terms of the Contract. In the event of the Tender not being accepted the certified cheque or irrevocable standby letter of credit, will be returned to the Bidder.

**10.0 DELIVERY OF TENDER.** As instructed by Public Tender Office.

**11.0 MODIFICATION OF TENDER.** If the Contractor wishes to make a change(s) to their bid, these changes must be received by the Public Tender Office prior to the posted closing time, subject to its acceptance. All changes must be shown on the Form entitled "Modification of Tender". A sample form is shown in Appendix "A" of these Standard Specifications. The change(s) must state the Tender Number, Project Number, followed by the Item Number(s) and Description(s). The difference in the change of the unit

price for all Items must also be shown. All changes in unit prices must be written in ink, both in words and numerals.

**12.0 WITHDRAWAL OF TENDER.** A Bidder will be permitted to withdraw his Tender unopened after it has been deposited if such request is received in writing prior to the bid closing time.

**13.0 DISQUALIFICATION OF TENDER.** More than one tender from an individual firm, partnership, corporation or association under the same or different names will not be considered. Collusion between Bidders will be sufficient cause for the Rejection of all bids so affected.

**14.0 COMPETENCY OF BIDDERS.** The bidder must be capable of performing the various items of work bid upon. They may be required to furnish to the Department a statement covering experience on similar work, lists of machinery, plant, and other equipment available for the proposed work and such statements of their financial resources as may be deemed necessary.

**15.0 MATERIAL GUARANTY.** Before any Contract is awarded the Bidder may be required to furnish a complete statement of the origin, composition and manufacture of any or all materials to be used in the construction of the work included in the Contract together with samples, which samples may be subjected to any and all tests required by the Department to determine their quality and fitness for the work.

**16.0 VALUE ENGINEERING ALTERNATE (VEA).** A Value Engineering Alternate will be entertained on selected Department contracts. Such contracts will be noted in the Special Provisions of said contract.

A VEA will not be considered when awarding the Tender. Award of the Tender will be based solely on the original Tender proposal and design. The VEA may be accepted or rejected by the Department at its sole discretion. The proposing of any design does not place the Department under any obligation to accept the design. Net construction savings will be shared equally between the Contractor and the Department. Minimum overall savings will be identified, confirmed and fixed prior to the Department giving approval to a VEA. All other terms and conditions will be as specified in the Department's VEA policy contained in Appendix 'D' of these specifications.

**17.0 PROCEDURES FOR TENDER OPENINGS**

**17.1 Tender Opening.** Tenders will be checked at the tender opening for the following three items. Failure to meet the requirements of these three items will

**Division 1 General Requirements and Covenants****Section 2 Instructions to Bidders**

result in the rejection of the tender.

- **Security Deposit.** Must meet the requirements of Clause 9 in the "Instructions to Bidders".

- **Omissions.** The following items (a) and (b) must be signed by the bidder as an acknowledgement of the receipt and understanding of the document and a signed copy of each document must be included with the tender.

- (a) Special Provisions

- (b) Addendums where applicable

- **Tender.** Must be submitted on a form supplied by the Department.

- Blank spaces must be filled in correctly for each item where a quantity has been given if the figure to be used is zero.
  - Unit prices, even if the figure to be used is zero, must be written in ink or typewritten and must be given in both words and numerals in the appropriate columns.
  - There can be no alterations to forms unless

called for in a Department Addendum.

- There can be no conditions attached to the tender by the Bidder.
- The tender must be properly signed as outlined in Clause 4 of the "Instructions to Bidders."

**17.2 Detailed Review of Tender.** All tenders not rejected at the tender opening will be subject to a detailed review by Department staff before a recommendation can be made for award of tender. This detailed review will take place as soon as possible after the public opening and will consist of the following:

- Check for arithmetic errors. In cases where the written unit price does not agree with the numeric price, the written unit price will be used. All mathematical errors will be corrected by Department staff and the rating of tenders as to total bid will be based on the corrected totals.
- A further review of the items listed in steps 1, 2 and 3 above will be carried out by the Department staff on the tender package being recommended for award of this contract.
- Tender in which the prices are obviously unbalanced may be considered for rejection.



## Division 1 General Requirements and Covenants

## Section 3 Agreement

## SECTION 3 - AGREEMENT

**THIS AGREEMENT** made  
this..... day  
of.....

in the year Two Thousand  
and.....by and  
between

herein called the **CONTRACTOR**, the Party of the First Part, and **HER MAJESTY THE QUEEN**, in the right of Her Province of Nova Scotia as represented in this behalf by the **HONOURABLE MINISTER OF TRANSPORTATION and PUBLIC WORKS** of the Province of Nova Scotia herein called the **MINISTER**, the Party of the Second Part.

**WITNESSETH, AS FOLLOWS:**

**1.0 GENERAL COVENANT.** The Contractor hereby covenants and agrees with the Minister as herein provided in connection with the following work, namely:

**2.0 NO IMPLIED CONTRACT.** It is hereby understood and agreed between the Parties hereto that no implied contract of any kind whatsoever, by or on behalf of the Minister, shall arise or be implied from anything contained in this Contract, or from any position or situation of the Parties at any time. It is further agreed that this Contract made by the Minister is and shall be the only Contract, upon which any rights against him are to be founded.

**3.0 HOW PARTY OF FIRST PART IS READ.** Whenever this Agreement is entered into by more than one Party or Parties of the First Part, the word "Contractor" shall be read "Contractors." All pronouns in the Contract referring to the Contractor shall be read as plural and whenever a Corporation is the Party of the First Part, the said pronouns shall be read accordingly.

**4.0 CONSTRUCTION OF CLAUSE AS COVENANTS.** Whenever it is stipulated in any part of the Contract that anything shall be done or performed by either of the Parties hereto, it shall have the same effect and be construed as if such Party had entered into a covenant with the other Party to do or perform the same, and as if any such covenant had been expressly made on the part of the Contractor not only on his own behalf but

also on behalf of his legal representatives, Successor or Assigns; and as if any such covenant on the part of the Minister and been made on behalf of himself and his Successors in Office.

**5.0 PERFORMANCE BY CONTRACTOR.** All Contractors shall, at their own cost and expense, furnish and provide all and every kind of labour, superintendence, services, tools, implements, machinery, plant, materials, articles and things whatsoever necessary for the due execution and completion of the work. They shall fully construct, erect and complete the same within the time specified, in the most thorough, workmanlike and substantial manner, in every respect to the satisfaction and approval of the Engineer, and deliver the same to the Minister, all in the manner and upon the terms and conditions of the Contract.

**6.0 SECURITY DEPOSIT.** The Contractor hereby and herewith deposits with and delivers to the Minister a security for the due fulfilment of their contract in the sum of..... dollars (\$.....) upon the express understanding that the same will be held and retained by the Minister until the Minister is satisfied that the work has been completed and all provisions of the contract have been met, (ie. Article **26.0 CLAIMS AGAINST CONTRACTOR** of the General Provisions) and the warranty period has expired, whichever is later, as security for the due and faithful performance, observance and fulfilment by the Contractor of all the covenants, provisions, agreements, conditions and reservations in this contract contained, on the part of the Contractor to be observed, performed and complied with. Provided always and it is understood and agreed that the Contractor assumes the risk and must bear any loss in respect to the security deposited as aforesaid occasioned by the failure or insolvency of the banks on which any certified cheque or letter of credit was drawn or in which any deposit was made in connection with the security aforesaid.

The expiration date for any Irrevocable Standby Letter of Credit used as security for this contract shall be dated no earlier than ..... If at any time during the execution of this contract, the Department determines that the completion of any portion of work included in this contract may extend beyond the expiration date, the Contractor shall provide to the Engineer, a new Letter of Credit in the amount of ..... with an expiration date dated one year beyond the original expiration date or written proof from the issuer of the original Letter of Credit that it has been extended. If a new Letter of Credit or proof of extension is not provided to the Engineer more than 10 working days

**Division 1 General Requirements and Covenants****Section 3 Agreement**

prior to the present expiration date, the Department shall automatically draw the full amount of monies stated in the Letter of Credit and hold such monies until a new Letter of Credit or proof of the extension is provided to the Engineer.

If at any time hereafter the Contractor should make default under the said Contract, or if the Minister, in his sole discretion, acting under the powers reserved in the said Contract, shall determine that the said works, or any portion thereof remaining to be done, should be taken out of the hands of the Contractor, and be completed in any other manner whatsoever than by the Contractor, or if the Contractor refuses or neglects to pay any salaries or wages or any accounts for materials due by the said Contractor for work done or materials supplied by any person in connection with the said work, the Minister may, in either case, dispose of said security and of the interest which may have accrued thereon, for the carrying out of the construction and completion of the work of the Contract, or for paying any salaries or wages for work done, or any accounts for materials supplied for the said works that may be left unpaid by the said Contractor.

In the event of any breach, default, or nonperformance being made or suffered by the Contractor in respect of any of the terms of conditions, covenants, provisions, agreements, or restrictions herein contained, which on the part of the Contractor should be observed, performed or complied with, the said money, and interest thereon, so delivered to or deposited with the Minister, or by him received in respect thereof, shall, by the Contractor, be forfeited absolutely to the Minister.

Upon the due and faithful performance, observance and fulfilment by the Contractor of all the terms, provisions, covenants, agreements, conditions and reservations, herein before contained, on the part of the Contractor to be observed, performed and complied with, the Contractor shall be entitled to be repaid or to receive again the money so deposited, together with so much interest upon such money as the Minister may, during his retention or possession of the same, actually receive by reason thereof. However, it is understood that the Minister shall not be under any obligation to cause the said money to be placed at interest, or to earn, or to endeavour to earn, interest thereon.

**7.0 MINISTER COVENANTS TO PAY.** In consideration of the faithful performance by the Contractor of all and singular the covenants, agreements and provisions of the Contract, the Minister hereby covenants and agrees with the Contractor that, on the full completion by the Contractor of all the work as specified in the contract, within the time specified and limited for the final completion thereof, and to the entire satisfaction of the Engineer, to be evidence by

the certificate of the Engineer in writing, he, the said Minister, will well and truly pay or cause to be paid to the Contractor the amount of the Contract price, being the actual quantities in the several items in the schedule of Prices contained in the Tender at the unit prices or bulk sum, prices quoted by the Contractor. This amount paid to the Contractor as above shall include all and every kind of work, labour, superintendence, services, tools, implements, machinery, plant, materials, articles and things whatsoever necessary for the full execution and completion of the work to the entire satisfaction of the Engineer. In case of dispute as to what work, labour, superintendence, services, tools, implements, machinery, plant, materials, articles and things are or are now so included, the decision of the Engineer shall be final and conclusive.

**8.0 FINAL PAYMENT.** It is hereby agreed between the Parties hereto that the payment of the final amount due under the Contract, and the adjustment and payment of any bills that may be rendered for work done, in accordance with any alteration in or addition to the same, shall release the Minister from any and all claims or liability on account of work performed under the said Contract, or any alteration in, or addition to the same. It is further agreed that before final payment is made by the Department to the Contractor, the Contractor shall furnish the Department with a release on the Release Form attached to this Agreement and identified by the Contractor's signature thereon.

**9.0 NO WAIVER.** The Contractor agrees that no condoning, excusing, or overlooking by the Minister, or any person acting upon his behalf, or previous occasions, or breaches, or defaults, similar to that for which any action is taken, or power is exercised, or forfeiture is claimed or enforced against the Contractor, shall be taken as a waiver of any provision of the Contract, or as defeating, affecting, or prejudicing in any way the rights of the Minister under the Contract.

**10.0 INCORPORATION IN CONTRACT.** Department of Transportation and Public Works Standard Specification dated February 1, 1997, Tenders and Special Provisions contained in a list attached hereto, together with the Instructions to Bidders, Release from All Liabilities and plans are hereby made a part of and incorporated in this agreement as fully and to the same effect as if the same had been set forth at length in the body of the agreement.

**11.0 WORKER'S COMPENSATION**

**11.1 Letter of Good Standing.** The Contractor is to provide a Letter of Good Standing from Workers' Compensation Board of Nova Scotia indicating the Contractor is assessed and is in good standing, before



## Division 1 General Requirements and Covenants

## Section 3 Agreement

any contract is awarded. The Contractor shall remain so for the duration of the contract.

**11.2 Letter of Clearance.** Upon completion of the work, and prior to the release of the holdback, the Contractor shall provide a Letter of Clearance from Worker's Compensation Board of Nova Scotia indicating the Contractor is assessed and is in good standing.

**12.0 CERTIFICATE OF RECOGNITION**

**12.1 Letter of Good Standing.** The Contractor shall provide within forty-eight (48) hours of request, before any contract is awarded, a Certificate of Recognition issued jointly by the Nova Scotia Department of Labour and an occupational health and safety organization approved by the Nova Scotia Department of Labour (such as the Nova Scotia Construction Safety Association), or a valid Letter of Good Standing from an occupational health and safety organization approved by the Nova Scotia Department of Transportation and Public Works indicating that the Contractor is in the process of qualifying for the Certificate of Recognition. The Contractor shall remain in good standing for the duration of the contract.

The Contractor shall provide within ten (10) days after award of contract a copy, provided by each Subcontractor, of their Certificate of Recognition issued jointly by the Nova Scotia Department of Labour and an occupational health and safety organization approved by the Nova Scotia Department of Labour (such as the Nova Scotia Construction Safety Association), or a valid Letter of Good Standing from an occupational health and safety organization approved by the Nova Scotia Department of Transportation and Public Works indicating that the Contractor is in the process of qualifying for the Certificate of Recognition. The Subcontractor shall remain in good standing for the duration of the Contract. Consideration will be given to permitting the Contractor to name additional Subcontractors during the course of the contract (i.e. after the ten (10) days, following award, has expired). In such cases, said Subcontractors shall not be permitted to carry out work on the contract until such time that the Contractor has provided the above information for each Subcontractor so named.

**13.0 EMPLOYMENT OF CONTRACTOR AND WORKMEN.** It shall be a condition of this contract that, at the time the contract is entered into, the Contractor must be a resident of Canada or if the Contractor is a corporation, it was for a period of at least one year immediately prior to that time, incorporated and carrying on business in Canada or the owners of a majority of the shares of such a corporation were resident, for a period of at least one year prior to incorporation, in

Canada. Canadian material is to be used in carrying out the work to the full extent to which it is procurable, consistent with proper economy and the expeditious carrying out of the work. Residents of Canada, only, are to be employed on the work. In employing persons there shall be no discrimination in favour of or against any person by reason of race, sex, religious views or political affiliations.

The following is the practice to be adhered to by all Contractors working on Department contracts and shall apply to materials, as noted in the following, hauled after 12:00 noon, local time, on the date of the tender closing.

The 80-20 rule shall apply to the hiring of local trucks for Department operations. At least 80% of the trucks hired on NSDOT&PW contracts must be private trucks hired, on a rotational basis, through the local branch of the Truckers Association of Nova Scotia, so that all trucks in the area receive a relatively equal amount of work. This is referred to as the 80-20 rule.

**13.1 Hauling of Granular Materials and Asphalt Concrete.** The 80-20 rule applies to hauling of all granular materials (including rock fill and loose laid rip rap) and asphalt concrete from a pit, crusher or asphalt plant for a Department project. Department Truck Rates to apply.

**13.2 Hauling Materials To Produce Granular Materials.** The 80-20 rule applies to the hauling of all material which is to be used to produce granular material including stone chips (with exception of material to be used to produce asphalt concrete). Department Truck Rates apply.

**13.3 Hauling of Stone Chips For Seals.** The 80-20 rule applies to the hauling of stone chips for seals from the site where the stone chips are manufactured to a stockpile location on or near the contract and also from the stockpile on or near the contract to the spreader. Department Truck Rates apply.

**13.4 Hauling of Aggregates for Micro Surfacing.** The 80-20 rule applies to the hauling of aggregate for Micro Surfacing from the site where the aggregate is manufactured to a stockpile location on or near the contract. Department Truck Rates apply.

**13.5 Hauling of Excavation or Borrow Material.**

• *Section of Road Not Designated.* The 80-20 rule applies to the hauling of excavation and/or borrow material on a project where the section of road under contract is not designated. Department Truck Rates apply.



## Division 1 General Requirements and Covenants

## Section 3 Agreement

• *Part or All of Section of Road Designated.* The 80-20 rule applies to the hauling of excavation and/or borrow material over a non designated section of highway for a project where all or a portion of the section of road under contract is designated. Department Truck Rates apply.

**13.6 Hauling of Common and/or Borrow Material.** The 80-20 rule does not apply to hauling of common and/or borrow material for a project where the section of road under contract is designated, and the movement of material is confined to the designated limits. Department Truck Rates do not apply.

**13.7 Hauling of Blend Sand.** The 80-20 rule does not apply to the hauling of material (including blend sand) to be processed into asphalt concrete. Department Truck Rates do not apply.

**13.8 One Truck Only.** If only one truck is required on a contract the Contractor may use a truck of his own choice. However, to comply with the 80-20 rule, before the Contractor could use another truck of his choice he would have to have a minimum of 8 private trucks employed on the contract provided, of course, private trucks were available.

**13.9 General.** Granular material is deemed to include all classes of gravel, Special Gravel, Gravel Borrow, Rock Fill, Loose Laid Rip Rap and Fill Against Structure material.

The rates paid to all owners of trucks in the employ of the Contractor, Sub-contractor, or of any person doing or contemplating doing, the whole or any part of the work contemplated by the Contractor, shall be at least equal to the rates of pay fixed by the Minister from time to time. It should be noted, however, that the rate to be used when hauling items for which the Contractor is paid on a per tonne basis must be the tonne/km rate.

The rates paid to all labourers or other persons in the employ of the Contractor, Sub-contractor, or of any person doing, the whole or any part of the work for the Contractor shall be at least equal to the rates of pay

that may be fixed by the Minister from time to time.

Workmen shall not be required to work longer hours than those fixed by the custom of the trade in the district where the work is carried on, except for the protection of life or property, or in case of other emergencies. In the event of a dispute arising as to wages, or what are the current hours fixed by the custom of the trade, it shall be determined by the Minister whose decision shall be final.

In the event of default being made in payment of moneys owing to any person employed on the said work and if a claim, therefore, is filed in the office of the Minister and proof thereof satisfactory to the Minister is furnished, the said Minister may pay such claim out of any moneys at any time payable by the Minister under said contract, and the amounts so paid shall be deemed payments of the Contractor.

**SIGNED, SEALED AND DELIVERED**

**IN WITNESS WHEREOF** the Parties hereto have herewith cause These Presents to be signed, and sealed, on the day and year first above written.

By the Contractor in the Presence of

.....  
 Contractor  
 Witness

**SIGNED, SEALED AND DELIVERED**

by the Minister in the Presence of

.....  
 Minister  
 Witness

## Division 1 General Requirements and Covenants

## Section 4 General Provisions

**SECTION 4 - GENERAL PROVISIONS**

**1.0 INVESTIGATION OF EVERY CONDITION OF THE WORK.** The contract is made and entered into by the Contractor and the Minister on the distinct understanding that the Contractor had, before execution, investigated and satisfied himself on the character and topography of the county, its streams, water courses and rainfalls, the dimensions, levels, character and nature of all existing works, buildings, constructions, road, lands, waterways, sewers, pipes, the nature of the strata through which excavations, if any, are to be made, and all other things and of every condition affecting the works to be executed and the labour and material to be provided, and that the execution of this contract by the Contractor is founded and based upon his own examination, knowledge, information and judgement, and not upon any statement, representation or information made or given, nor upon any information derived from any quantities, dimensions, tests, specifications, plans, maps, or profiles made, given or furnished, by the Minister or Minister's representative. Any such statement, representation or information, if so made, given or furnished, was made, given or furnished merely for the general information of bidders and is not in anyway warranted or guaranteed by or on behalf of the Minister. No extra allowance will be made to the Contractor by, and the Contractor will make no claim against the Minister for any loss or damage sustained in consequence, or by reason of, any such statement, representation or information being incorrect or inaccurate, or on account of excavating in rock or other difficult ground, or of unforeseen difficulties of any kind.

**2.0 INTENT OF PLANS AND SPECIFICATIONS.** The plans and specifications are to be taken co-jointly, each as explaining the other. The two together shall be held to cover and to be descriptive of any and all work that could reasonably be required to be done, in order to properly complete the work under this contract. Should there be any discrepancy or disagreement between the figures on the plans, and the scale of the same, or between the descriptive writings on the plans, and the specifications, the Engineer shall decide which is to be followed. Should there be anything shown on the plans but not described in the specification, or vice versa, the work shall be fully executed and carried out, just as if fully shown and described in both.

Any and all minor details of the work not specifically mentioned in the specification or shown on the plans, but obviously necessary for the full and proper completion of the work, shall be considered as incidental, and as being a part of and included in the work, to be done under the contract. The Contractor will not be entitled to any extra or additional compensation for such work. Should any dispute arise

between the Engineer and Contractor as to the true meaning of the plans and specifications upon any point, the decision of the Engineer shall be final and conclusive. Whenever it is specified that the Contractor must prepare his own plans, the approval of such plans by the Engineer shall be general only and such approval will not relieve the Contractor from any responsibility whatsoever. The Contractor will not be allowed any compensation for such plans and the contract price shall include the cost of furnishing them.

**3.0 WHAT ITEMS IN CONTRACT INCLUDE.** The description of the work and any portion thereof and of the materials referred to by any item of which a price is given in this contract, includes not only the particular kinds of work or materials mentioned in the said item, but also all and every kind of work, labour, tools, plant, materials, equipment, articles, and things whatsoever necessary for the full execution, completion, and delivery, ready for use, of such respective portions of the works, in accordance with the plans, drawings and specifications, to the satisfaction of the Engineer.

In order to facilitate Department accounting some contracts are made up of two or more Sections as described on the Tender Forms.

If, during the conductance of a Contract which consists of more than one Section, work is authorized by the Engineer for which there is no Tender Item or Unit Bid Price then the work will be carried out by the Contractor, and payment for this work shall be made as per the Tender Unit Bid Price as shown on the Main Section of the Contract. The Main Section of the Contract either shall be designated later in these provisions or shall be determined by the District Director.

**4.0 TIME OF COMMENCEMENT.** The time of commencement and the rate of progress made with the work shall be such as to ensure its final completion on or before the completion date specified in the contract documents.

**5.0 TIME OF COMPLETION.** The whole of the work to be done under this contract shall be finally completed in full accordance with all the terms and conditions of this contract on or before the day specified for such completion in the Tender which forms part of this contract. The Contractor shall complete as quickly as it is deemed practicable any portion of the contract upon which he has undertaken work.

**6.0 EXTENSION OF TIME.** The Department may consider an extension to the completion date of the contract, on the following basis:

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- Federal or Provincial Laws passed subsequent to the date of the contract adversely affecting progress.
- When the Contractor is requested by the Department to perform additional work or work beyond the scope of the original tender design, the Engineer will extend the completion date by the same proportion of time as the additional work bears to the original work.
- Delay by the Department in the issuance of any plans, materials, notices or other items which in the opinion of the Engineer interfered with the Contractor's approved start date and/or work schedule.
- Any other conditions which in the opinion of the Engineer warrants consideration for an extension of time.

Failure by the Contractor, in the opinion of the Engineer, to prosecute the work continuously and in the most diligent and efficient manner possible, using every means and alternative methods available to complete the project, will be cause for denial of any such time extension.

Proceeding with the work without a Work Schedule approved by the Engineer in accordance with Clause 1.40.20.3 of these Specifications, or non compliance with said Work Schedule in the opinion of the Engineer, will be grounds for denial of any requested time extension.

No extensions for weather will be considered between April 15 and December 1 whatsoever. The Department may consider an extension or suspension of the Contract between December 1 and April 15 of the following year, if in the opinion of the Engineer, it would be in the best interest of the Department. Liquidated damages as detailed in the contract documents will not be applied for extensions granted by the District Director for the period between December 1 and April 15.

Any extension of time that may be granted to the Contractor shall be so granted and accepted without prejudice to any rights of the Minister whatsoever, under this contract, and no assent thereto on the part of the Contractor shall be necessary.

**7.0 CHANGES IN CONTRACT.** The Engineer shall have the right and authority at any time, either before the commencement or during the construction of the work, or any portion thereof, to make any changes in the lines or grade or in the dimensions, form, plan, location, position and quantity of the work to be done, or of any part or parts thereof, or in any other thing connected with the work, whether or not such changes increase or diminish the quantity of work to be done, or the cost of doing the same. If the changes diminish, or increase the quantity of work to be done, they shall not

constitute a claim on the part of the Contractor for damages, or for any loss of anticipated profits. No changes or omissions shall in any way annul or invalidate the contract, but all additional work or changes in the work contracted for shall be considered and treated as if originally contracted for, and shall be subject to all the terms, conditions and provisions of the original contract. No deviations from the plans or specifications shall in any case be made by the Contractor without a written order signed by the Engineer, setting forth the nature and extent of the changes proposed.

**8.0 UNFORESEEN WORK**

**8.1 Unforeseen Work.** Unforeseen work, as defined in Division 1, Section 1 of these specifications, must be authorized and payment provided for by one of the two following methods:

**8.1.1 Letter of Quotation.** The Contractor shall submit a letter of quotation to the Department containing a unit price or prices for the additional work. The price or prices shall be approved by the Department before the commencement of work.

**8.1.2 Extra Work Order.** The Engineer shall issue a written Extra Work Order to the Contractor setting out the nature and extent of the extra work proposed. Compensation for the work is to be on a cost plus basis as described below. Statements of account shall be submitted on Department forms. All labour, materials, and equipment used shall be suitable to complete the work described and shall be approved by the Engineer prior to the work being done. Labour rates are to be actual labour rates paid by the Contractor to his employee. Equipment rates are not to exceed those contained in the Department's Schedule of Rental Rates for Construction Equipment. Truck rates shall be Department rates in effect at the time the work is done. Rates for equipment not contained in the Schedule of Rates shall be approved by the Engineer before the work is commenced. In cases where the Contractor does not have his own equipment available to complete the work and must hire equipment, the rate to be paid to the Contractor shall be approved by the Engineer before the equipment is hired. The actual cost of labour, materials, rented equipment and outside services, shall not exceed reasonable market value. The Contractor shall furnish the Engineer with supporting invoices for all materials, outside services and rented equipment for which the rates are not in accordance with the Department Schedule.

The Contractor will be allowed an additional 20% on the actual cost for labour, materials, outside services, and hired equipment. This additional percent is for the use of tools, Contractor's plant (except such plant as rentals

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have been agreed upon) Superintendent's payroll and profit.

**8.2 Refusal to do Work, Claims.** In the absence of a written letter of quotation or written Extra Work Order, the Contractor will not be entitled to payment for any such unforeseen work. If the Engineer and Contractor fail to agree upon the unit price quoted for the extra work, or the Contractor refuses to carry out the work as described in the Extra Work Order, the Engineer shall have the right to have the work carried out and completed by others. The Contractor shall have no claim for hindrances or delays caused by getting the unforeseen work completed.

In the case of work done under authorization of an Extra Work Order, the Contractor shall submit the necessary forms and supporting documentation to the Engineer within 60 days of the last day of the period during which work was done. The period referred to is the monthly period for which progress payment for work on the contract is normally made.

**9.0 ADDITIONAL WORK**

**9.1 Less than 10% of Original Tender.** Additional Work, as defined in Division 1, Section 1 of these specifications, less than 10% of the original tender must be authorized and payment provided for by one of the two methods outlined in Sections 8.1.1 and 8.1.2 of these General Provisions.

**9.2 Greater than 10% of Original Tender.** If the additional work is greater than 10% of the original tender, the additional items or work will be tendered in accordance with the Government tendering policy or an application for sole sourcing made to the Priorities and Planning Committee.

**10.0 WORK NOT IN CONTRACT.** The Minister may at any time without payment to the Contractor, send and employ on the work site, other contractors and workmen, with such machinery, tools, plant, equipment, materials and incidentals, as the Engineer may deem necessary to do any work not comprised in the contract. The Contractor shall afford to them all reasonable facilities to the satisfaction of the Engineer for doing such work. The work of the Contractor shall be interfered with as little as the Engineer may deem practicable. The taking of possession of the whole or any part of the work of the Contractor shall not be considered an acceptance by or on behalf of the Minister of the whole or any portion of the work comprised in the contract.

**11.0 INSPECTION GENERAL.** The Engineer may provide for the inspection of all materials used and work done under the contract by assistants and inspectors,

acting under his direction. Such inspection may extend to, and cover all or any parts of the work and also the preparation and manufacture, whether within the limits of the work or elsewhere, of any of the materials to be used, or for the execution and final completion of the said work. Inspectors shall have full authority to reject defective materials or workmanship, and to suspend the carrying out of any work that is being improperly done, subject to the final decision of the Engineer. Inspectors shall have no authority to permit deviations from, or to relax any of the provisions of the specifications, without written permission or instruction from the Engineer, nor to delay the Contractor in any way by failure to inspect material and workmanship, with reasonable promptness, when being notified by him. All materials and workmanship, will be inspected thoroughly and carefully, and the Contractor will at all times be held strictly to the spirit of the specification. All the work must be first-class in every particular and in thorough conformity with the plans and specifications.

**12.0 WORK UNDER CONTROL OF ENGINEER.** The work shall, in every particular, be under and subject to the control and supervision of the Engineer. All orders, directions or instructions at any time given by the Engineer with respect, thereto, or concerning the conduct thereof, shall by the Contractor promptly and efficiently be obeyed, performed and complied with, to the satisfaction of the Engineer. All instruction and directions or certificates given, or decisions made, by anyone acting under the authority of the Engineer shall be subject to his approval, and may be cancelled, altered, modified and changed as he may see fit. In cases where the Contractor or Minister is dissatisfied with the decision of anyone acting under the authority of the Engineer, an appeal, may be made to the said Engineer, whose decision in the matter shall be final and conclusive.

**13.0 ENGINEER'S DECISION FINAL.** It shall be distinctly understood that the sole and every part of the work to be done under this contract is to be executed and completed in full accordance with the plans and specifications covering the work, and any further orders or directions or instructions that may be given from time to time by the Engineer in regard thereto, and to the complete satisfaction of the said Engineer, as evidenced by his written certificate, which certificate, shall be a condition precedent to the rights of the Contractor to be paid for the work; and that the said Engineer is to be the sole judge and arbitrator as to the mode and manner in which the work is to be carried out, and as to the efficiency, quality and quantity of the work done or materials furnished under the contract. The Engineer shall also decide any and all questions that may arise as to the meaning or interpretation of the plans and specification, and every other matter and thing incident, to bearing upon or arising out of the



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plans, specification and contract. His judgement, decision, or award upon any and all such questions shall be absolutely final, binding and conclusive, as between the parties to the contract.

**14.0 QUALITY OF WORK AND MATERIAL.** All the work shall be constructed of the best materials of their several kinds, and shall be finished in the best and most workmanlike manner, in the manner required by, and in strict conformity with this contract, the plans and specification, and the working or detail drawings, which may from time to time be furnished, and to the complete satisfaction of the Engineer. The judgement and decision of the Engineer as to whether the materials supplied and the work done under the contract comply with the requirements of the plans and specification shall be final and conclusive.

**15.0 DEFECTIVE WORK AND MATERIAL.** No material shall be used in the work, or any portion thereof until it has been examined and approved of by the Engineer or his authorized representatives. All rejected materials must be removed from the site of the work and replaced with materials which are acceptable to the Engineer. Any work or materials which in the opinion of the Engineer, is not of the character, quality, dimensions, or design, required by the plans and specifications, and which, in the judgement of the Engineer, is otherwise or in any manner defective, imperfect, or insufficient, shall be replaced or remedied, when pointed out to the Contractor by the Engineer; and shall be made good and sufficient by the Contractor at his/her own expense, and to the satisfaction of the Engineer, who shall have found, and whose duty it shall be to have any defective work or materials taken out and rebuilt or replaced at the expense of the Contractor. Any omission by the Engineer to disapprove of or reject any insufficient or imperfect work at the time of any estimate shall not be deemed in acceptance of such work or material.

The Contractor shall, to the satisfaction of the Engineer, rectify any defects in the works which may appear therein, or of which he shall receive notice from the Engineer and for which he may have been responsible, in the opinion of the Engineer, during the period of thirty days after the date of the final certificate of the completion of the work. If the Contractor fails to renew any defective materials, or correct any defective workmanship within 24 hours after he has been instructed to do so by the Engineer, the Engineer may cause any such defective work or workmanship to be removed. The expense of such removal will be deducted from any moneys that may be due, or that may thereafter be or become due to the Contractor. The fact that any defective material or workmanship has been accepted previously by oversight of the Engineer or his representatives shall not be considered a valid

reason for the Contractor's refusal to remove it or make it good when notified to do so.

**16.0 MATERIALS FURNISHED BY THE DEPARTMENT.** When the Department is required to supply materials under this Contract, the Contractor shall decide when materials are required on the work, and shall notify the Engineer giving reasonable advance notice.

The full amount of material in each shipment must be accounted for by the Contractor and any theft or loss, or damage to materials after receipt will be charged against him. Materials supplied to the Contractor by the Department shall not be used by the Contractor for any purpose other than that for which they were supplied. Should any material supplied by the Department be damaged while in possession of or under the control of the Contractor, they shall be replaced by the Contractor at their own expense.

**17.0 LINES AND GRADES.** The work, and all parts thereof, is to be constructed according to the lines and grades on the plans, and must conform accurately to the same. The lines and grades will be given by the Engineer or his representative, and the Contractor must carefully preserve from injury or disturbance all stakes and bench marks set during the progress of the work for marking lines and grades. Should errors be made by the Contractor in working to the lines and grades as given by the Engineer, such mistakes and errors must be made good by the Contractor at their own expense.

**18.0 CONTRACTOR'S PERSONAL ATTENTION.** The Contractor shall give his constant personal attention to the work while it is in progress, or he shall place it in charge of a competent and reliable agent or representative who shall have authority to act for, and be considered the lawful representative of the Contractor. Any orders, or instructions regarding the work, which shall be given to the said agent or representative, shall be considered as given to the Contractor. The Contractor shall at all times employ a sufficient number of workmen or foreman for the proper performance of the work, which he shall prosecute to full completion in the manner and within the time as specified.

**19.0 REFUSAL OF CONTRACTOR TO DO WORK.** Should the Contractor neglect or refuse to do any work, matter or thing that they may be directed to do, or which may be necessary in order to complete the work in a proper manner according to the plans and specification, the Engineer may without further notice perform or do whatever in their judgement may be necessary. The entire cost shall be borne and paid by the Contractor, and may be deducted and paid out of any moneys which may be due or may thereafter become due the

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All machinery and other plant, materials, tools, equipment, articles and things whatsoever provided by the Contractor for the works hereby contracted for and not rejected or condemned for any reason shall, from the time of their being so provided, become, and until the final completion of the said work, shall be and remain the property of the Minister for the purposes of the said work; and the same shall on no account be taken away or used or disposed of otherwise, except for the purpose of the said work, without the written permission of the Engineer; and the Minister shall not be answerable for any loss or damage whatsoever which may happen to such machinery or other plant, materials, tools, equipment, articles and things, provided that always, upon the completion of the work and upon payment by the Contractor of all such moneys, if any, as shall be due from him to the Minister, such of the said machinery and other plant, materials and things, as shall not have been used and converted in the works, and which remain undisposed of, shall upon demand be delivered up and returned to the Contractor in such condition, as they may then be in.

Whenever on this contract, power or authority is given to the Minister, the Engineer or any person on behalf of the Minister to take any action consequent upon the happenings of any one of the events mentioned or referred to in the contract, or upon the acts, defaults, neglects, delays, breaches, non-observance or non-performance by the Contractor in respect of the works or any portion or details thereof, such powers or authorities may be exercised from time to time and not only in the event of the happenings of such contingencies before the time limited in this contract for the completion of the works, but also in the event of the same happenings after the time so limited in the case of the Contractor being permitted to further proceed with the execution of the work.

**20.0 POWER TO EMPLOY ADDITIONAL RESOURCES**

**20.1 Insufficient Materials and/or Equipment.** Notwithstanding the obligation of the Contractor to complete the contract within the time specified, where the Engineer is satisfied that the number of workers, equipment or materials used by the Contractor for the contract is insufficient to complete the contract within the time specified, the Engineer may, by written notice to the Contractor, require the Contractor to employ or provide such additional workers, equipment or materials as the Engineer may deem necessary to complete the contract within the time specified at the expense of the Contractor.

**20.2 Employment of Additional Workers, Equipment, Materials by Minister.** Where the Engineer is satisfied that the slow rate of progress on the contract is endangering the safety or health of any person or exposing part of it or public property to damage or destruction, the Engineer may either on behalf of the Minister or, if he sees fit as an agent or of account of the Contractor, but in either case at the expense of the Contractor, provide and employ such additional workers, equipment or materials as the Engineer thinks proper to diligently carry out the contract, and may pay such additional workers such wages, and for such additional equipment and materials, respectively, such prices as the Engineer thinks proper. All such wages and prices respectively are thereupon at once to be paid by the Contractor or the same may be retained or deducted out of any sum that may then, or thereafter, become due from the Minister to the Contractor; and the Minister may use in the execution and advancement of the contract not only the workers, equipment and materials so provided on their behalf, but also all such as may have been, or may be provided by, or on behalf of the Contractor.

**20.3 Schedule of Work.** The Contractor will be required to submit a schedule of work in accordance with the completion date of the project. No work shall commence until a work schedule has been provided to, and approved by the Engineer. The Engineer, may, during the course of the contract, require the Contractor to produce a revised schedule of completion indicating what additional workers, machinery, tools or other plant and equipment or the quantity of proper materials required to successfully conclude the contract within the completion date of the project.

**21.0 SUBLETTING OR ASSIGNING OF CONTRACT.**

The work under this contract shall be performed by the Contractor, and by workers under the Contractor's immediate supervision and superintendence. The Contractor shall not, without the written consent of the Engineer, make any assignment of this Contract, or any subcontract for the execution of any of the works hereby contracted for. 

This clause does not apply to the furnishing of materials for the different parts of the work, for which materials, however, the Contractor shall be held strictly responsible, and no excuse for the quality of the materials, or for the non-delivery of the same in good time by any Subcontractor, as effecting the progress of the work, will be entertained. In no case shall any assignment or subcontract, even though duly consented to, relieve the Contractor from his liability under this contract for the performance and completion of the works hereby contracted for. The Contractor shall not assign any moneys due or accruing under the contract under any circumstances.



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**22.0 DELAYS BEYOND TIME LIMIT.** No delay or delays within or beyond the time fixed for the completion of the work shall vitiate or render void the contract or any part thereof, or the obligations imposed upon the Contractor no delay shall make void or in any way impair or affect any current or other bond, guaranty, security, or obligation for the performance of the contract; the Contractor shall not have, nor make any claim or demand, nor bring any action, suit or petition against the Minister for any damage which he/she may sustain by reason of any delay or delays, from whatever cause arising in the progress of the work.

**23.0 CONTRACTOR LIABLE FOR RISKS.** The Contractor shall assume all risks and contingencies in connection with the work, and shall bear all loss or damage whatsoever, whether arising from storms, floods, fires, accidents or any other cause whatsoever which may occur to the works or any part thereof, during the progress of the work and until the same shall be fully and finally completed and delivered up to and accepted by the Minister. If any such loss or damage shall occur before such final completion, delivery and acceptance of the work, the Contractor shall immediately, at their own expense, repair, restore and re-execute the work so damaged within the specified time for completion. The Contractor must make good at his own expense all deficits and failures from any causes whatsoever, whether the same are due to negligence on his part, or on the part of his workmen, or persons employed by the Contractor, or under their control, or due to bad workmanship; and the Contractor shall indemnify and save harmless the Minister from any and all claims, losses or damages in respect thereof.

**24.0 CONTRACTOR LIABLE FOR DAMAGES.** The Contractor, agents and all workpersons and persons employed by the Contractor or under the Contractor's control, and all servants and agents of his Subcontractor, if any, shall use due care that no person or property is injured and that no rights are infringed in the prosecution of the work. The Contractor shall be solely responsible for all damages, by whomsoever claimable, in respect of any injury to persons or to property of whatsoever description, and in respect of an infringement of any right, privilege or easement whatsoever, occasioned in the carrying on of the works or any part thereof, or by any neglect, misfeasance or non-feasance on the Contractor's part or on the part of any of his agents, workmen or persons employed by him or under his control or any of his Subcontractors, their servants or agents, and shall at his own expense, make such temporary provisions as may be necessary to ensure the avoidance of any such damage, injury or infringement, and to prevent the interruption of, or damage or menace to, the traffic on any public or

private road, and to secure to all persons and corporations the uninterrupted enjoyment of all their rights, in and during the performance of the said works. The Contractor shall indemnify and save harmless the Minister from and against all claim and demands, loss, costs, damages, actions, suits or other proceedings by whomsoever made, brought or prosecuted, in any manner based upon, occasioned by, or attributed to any such damage, injury or infringement.

**25.0 GRAVEL REMOVAL FROM RIVERS.** In order to avoid situations whereby Contractors on highway work might destroy valuable fish spawning grounds by removing gravel from river beds, no work shall be done in, or material removed from the bed of a stream without the specific consent of the Project Engineer.

**26.0 CLAIMS AGAINST CONTRACTOR.** The Contractor shall promptly pay for all labour, services and materials, in or about the construction of the work; and all payments for such purposes, shall be made by the Contractor, at least as often as payments are made by the Minister to the Contractor. Payments to truckers employed in the hauling of materials used in the construction, shall be made bi-weekly with payment for one pay period made prior to the end of the following pay period.

Where a Subcontractor or supplier claims not to have been paid the amount owing under contract within 30 days after it is due, the Subcontractor or supplier may file a notice of claim with the Minister within 60 days after the initial 30 day period. The Minister will give notice of the Subcontractor or supplier's claim to the Contractor and retain the disputed amount until the claim is settled by the parties. If the Minister has not been advised within 60 days from the date of the notice of claim that the claim is settled by agreement, subject to an agreed upon dispute resolution process or that judicial proceedings have been commenced, the Minister will pay the disputed amount to the Contractor

Before final settlement is made for work done and materials furnished under the contract, the Contractor may be required to furnish evidence satisfactory to the Minister that the said work and all its parts are free and clear from all lawful claims or liens under any law, for labour, workmanship, material or otherwise; and that no claim then exists, in respect of which a claim or lien upon the said work could, or might attach. The Contractor shall indemnify and hold harmless the Minister, and all his property, from any and all kinds of liens, occurring from labour and services performed and materials furnished, or otherwise, and any of the same, in or about the said work. In the event the Minister consents in writing to any subcontract for the execution of any work hereby contracted for, the Contractor shall ensure that all accounts for labour, services and

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materials in or about the construction of that part of the work are paid by the Subcontractor and shall furnish for the Minister a certificate in writing that such accounts have been paid.

**27.0 CLAIMS OF CONTRACTOR.** It is intended that every allowance to which the Contractor is fairly entitled will be embraced in the Engineer's monthly certificate; but, should the Contractor at any time have claims of any description which he considers are not included in the said certificate, such claims must be made in writing to the Engineer within 30 days after the date of the delivery to him of the certificate, from which he considers the items of his claims to have been omitted, and in no case beyond the period of 60 days from the date of the practical completion of that portion of the work, to which such claims apply. In default of the presentation of such claims within the time or times so limited, the Minister may treat such claims as absolutely barred. The Contractor in presenting claims of the kind referred to above, must accompany them with satisfactory evidence of their accuracy, and the reasons for the claims.

Where after the tender closing date for this contract, there is a change in the amount of Federal Excise Tax or Import Duties payable on materials placed or furnished or to be placed or furnished in the work, the Department will increase or decrease contract payments by the amount necessary to offset the effect of the Tax or Import Duties on this contract.

Claims by the Contractor for compensation to cover increased costs caused by the Tax or Import Duties must be submitted to the Engineer within **30 days** after the **Engineer's Certificate of Final Estimate** is received by the Contractor. No claim submitted beyond the 30 day limit will be considered.

Where the Contractor benefits from a change in the Tax or Import Duties, the Contractor shall submit to the Engineer a statement of such benefits. This statement must be provided within **30 days** after the **Engineer's Certificate of Final Estimate** is signed.

The Engineer reserves the right to make deductions from regular progress payments to account for any estimated benefits accrued to the Contractor from the Tax or Import Duties. Such deductions will be held pending receipt of the above mentioned statement itemizing the benefits which the Contractor has received from the Tax or Import Duties, at which time the final payment adjustment will be determined. (See also Division 1 Section 2 Paragraph 6 of these Specifications)

**28.0 SANITARY PROVISIONS.** All Contractors shall provide and maintain in a condition satisfactory to the

Engineer all necessary accommodations for the use of their employees on the work.

**29.0 CHARACTER OF WORKMAN AND EQUIPMENT.** The Contractor shall at all times employ sufficient labour and equipment for prosecuting the several classes of work to full completion in the manner and time specified.

Any person employed by the Contractor, who, in the opinion of the Engineer, does not perform their work in a proper and skilful manner, or is disrespectful, intemperate, disorderly, or otherwise objectionable shall, at the written request of the Engineer, be forthwith discharged and such persons shall not again be employed in the work.

All machinery and equipment owned or controlled by the Contractor, which is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet with the requirements of the work, to produce a satisfactory quality of work. The Engineer may order the removal and require replacement of any unsatisfactory equipment.

No change in the machinery and equipment employed on the work, which shall have the effect of decreasing its capacity, shall be made except by written permission of the Engineer. The measure of the capacity of machinery and equipment shall be its actual performance on the work.

**30.0 RECORDS OF CONTRACTOR OPEN FOR INSPECTION.** The Contractor shall keep complete records of the time worked by each of their employees on this work, and such pay-rolls, time books, books or accounts, invoices and statements shall be at all times open for inspection and audit by the Minister or Minister's representative, who shall be assisted in every possible way by the Contractor to enable the Minister or such representative to ascertain as far as possible, the exact payment, sums or claims so due and remaining unpaid by the Contractor.

**31.0 NOTICE TO CONTRACTOR.** Any notice, order, direction or other communication mentioned in this contract to be notified, or given the Contractor, shall be deemed to be well and sufficiently notified or given, if the same be given by the Engineer or Engineer's representative, and be delivered to the Contractor personally or the Contractor's representatives or foreman on the work, or left at the Contractor's office, or mailed in any post office to the Contractor or his agent, addressed to the address mentioned in this Contract, or to the Contractor's last known place of business or residence.

**32.0 CLEANING OF PREMISES.** The Contractor shall

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upon completion of the work remove all temporary structures and clear away all rubbish, surplus and waste materials remaining on or about the works and place the premises in a neat and tidy condition satisfactory to the Engineer.

**33.0 FIRE PROTECTION.** The Contractor shall, at his own expense, take special precautions to prevent fire occurring in or about the works, and employ his own workmen, to the satisfaction and under the direction of the Engineer, in extinguishing all such fires which may occur. The Contractor shall observe and comply with all laws and regulations and instructions made and given, from time to time during construction, by the Engineer, with respect to fires and the prevention and extinguishing of fires, and shall pay all wages and other costs occasioned by reason of the observance or compliance with such regulations and instructions.

**34.0 ACCOMMODATING TRAFFIC AND TRAFFIC CONTROL.** Unless otherwise provided, the Contractor shall, at his own expense and without extra cost to the Minister, make suitable provision to accommodate all traffic, either pedestrian or vehicular over any part of the highway upon which work is being performed, in a manner satisfactory to the Engineer and shall arrange to keep two lanes of highway open to traffic at all times with the least amount of inconvenience to the travelling public. On upgrading work the subgrade shall be completed progressively in order that the various courses of gravel may follow in an orderly manner. The grading operation shall not precede the gravel operation by a distance greater than 1 km and not more than 1 km of the original travelled way shall be disrupted at any one time. However, other work not affecting the original travelled way may proceed as directed by the Engineer.

Prior to closing down the operation on each working day, the Contractor shall ensure that the travelled way is capable of carrying traffic even under adverse conditions. The reconstructed travelled roadway is to be well maintained and graded on a daily basis by the Contractor as directed by the Engineer until the completion of the Contract.

Where in the opinion of the Engineer, it is desirable to;

- **detour traffic via alternate highways** because of construction work on a project and
- where **short detours** are required around excavations, partially built structures, etc., on work under contract, the Contractor is to be paid for the cost of construction and maintenance of the detour.

The Contractor is advised that construction signs for any contract shall not be erected until immediately prior to the commencement of work.

The Contractor shall be responsible to provide and maintain all traffic control required on the Contract. Traffic Control shall be carried out in accordance with the current edition of the Nova Scotia Traffic Control Manual and as directed by the Engineer.

The Contractor shall provide an Accredited Traffic Sign Supervisor, who has successfully completed the Temporary Workplace Traffic Control Training Course to be on site at all times when active construction is taking place, to ensure the dismantling of all temporary condition signs and devices that indicate to the road user that highway construction activities exist and also to ensure that proper traffic control procedures are carried out in accordance with the Nova Scotia Traffic Control Manual.

The Contractor may, if so requested by the Engineer or other approved traffic authorities, be required to submit a list of workmen to whom concerns about the condition of all or any, of the Traffic Control devices, required for the Contract, can be directed during non active construction periods.

Traffic Signs will be supplied to the Contractor by the Department. Traffic signs will be available at the Engineer's Field Office.

Signs, including hazard markers, not returned at the end of the job, will be charged to the Contractor at **100%** of replacement cost.

Drums and Cones required for Traffic Control shall be supplied by the Contractor at no cost to the Department.

All TC-5 (ROADWORK) and TC-6 (TRAFFIC CONTROL PERSON AHEAD) signs used on any job shall be equipped by the Contractor with two flags (including flag holder), at no cost to the Department, as per the requirement of the Nova Scotia Traffic Control Manual. All signs shall be Level I reflectivity as per specification 62-GP-11M.

All costs associated with the handling, erection, placement and removal of traffic signs, cones and drums, including the maintenance of such during inactive construction periods, shall be incorporated into the tender prices for other contract items.

Traffic Control Persons and Flashing Light Units will be provided and paid for as specified in Division 6 Section 3 - *Traffic Control Persons* and Division 6 Section 4 - *Flashing Light Units* in these Standard Specifications.

On low volume roads and low volume urban residential streets where a 360 degree amber light is required in the placement and dismantling of safety devices, the



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360 degree amber light (and vehicle) will be supplied by the Contractor at no cost to the Department.

Unless specified elsewhere in these provisions it shall be the Contractor's responsibility to erect and maintain all signs relative to any contract to meet the requirements laid down in the current edition of the Nova Scotia Traffic Control Manual.

**35.0 DESIGNATED HIGHWAYS.** The Minister as provided for in Section 6 of the Regulations respecting the Weights and Loads of Vehicles made pursuant to the provisions of Section 172 of the Motor Vehicle Act will designate certain portions of highways as follows with or without a formal request having been made as indicated.

**35.1 Grading Contracts.**

**35.1.1** The section of highway under contract excepting all bridges will be designated at the time said contract is awarded without formal request from the Contractor.

**35.1.2** Bridges within the limits of the contract may be designated on formal request from the Contractor provided the structure is deemed capable of bearing the increased loading. The Contractor may be required to reinforce the structure to the satisfaction of the Engineer.

**35.1.3** Sections of highway and bridges therein that may be used for purposes incidental to a highway under contract may be designated on formal request from the Contractor. The Contractor may be required to reinforce the structure to the satisfaction of the Engineer.

**35.2 Upgrading Contracts.**

**35.2.1** A section of highway under an upgrading contract may be designated on formal request from the Contractor provided the request is favourably recommended by the District Director, except the designation will not be permitted on any paved highway or paved portion of the contract. If a paved surface is to be pulverized, designation will be considered.

**35.2.2** Bridges within the limits of the contract may be designated on formal request from the Contractor provided the structures are deemed capable of bearing the increased loading. The Contractor may be required to reinforce the structure to the satisfaction of the Engineer.

**35.2.3** Sections of highway and bridges therein that may be used for purposes incidental to a highway under contract, may be designated on formal request from the Contractor. The Contractor may be required

to reinforce the structures to the satisfaction of the Engineer.

**35.3 Paving Contracts.**

**35.3.1** A section of highway under a paving contract may be designated on formal request from the Contractor provided the request is favourably recommended by the District Director, except the designation will not be permitted on any paved highway or paved portion of the contract.

**35.3.2** Sections of highway and bridges therein that may be used for purposes incidental to a highway under contract, may be designated on formal request from the Contractor. The Contractor may be required to reinforce the structures to the satisfaction of the Engineer.

**35.4 Repaving Contracts.** A section of highway under a repaving contract will not be designated because of its paved surface. If the surface is to be pulverized, then consideration may be given to the designation.

A section of highway designated by the Minister is only designated with respect to vehicles owned or hired by the Contractor or his Subcontractor and being used to do work on the contract.

The Contractor shall, at no cost to the Department, carry out grading, gravelling, and dust control operations on the designated road(s) as required to maintain a riding surface acceptable to the Department during the course of the operation. Said road(s) shall be left in a condition acceptable to the Department on completion of the work.

**36.0 REGISTERED WEIGHT AND AXLE WEIGHT.** The maximum permitted weight on an axle, combination of axles, vehicle or combination of vehicles on any public highway in Nova Scotia shall be in accordance with Regulations Respecting the Weights and Loads of Vehicles made pursuant to Section 191 of the Motor Vehicle Act, Chapter 293 R.S.N.S. 1989 as amended by 1990 c.36 by the Minister and in effect at the time the vehicle (or axle) is in use.

**37.0 WEIGHING PROCEDURES.** The weighing procedures to be followed by Department weighers on contract or Department work will be carried out on the basis of determining "Pay Load" only.

Trucks hauling on contract or Department projects, and weighed by Department weighers will not be issued a weight slip if the total gross is in excess of the vehicle's registered weight plus the allowable axle tolerance.

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A sign which reads as follows must be prominently displayed on each scale house so that it can be easily read by the Truck Driver.

**THIS SCALE WILL DETERMINE PAY LOAD ONLY. NO WEIGHT SLIP WILL BE ISSUED IF THE TOTAL LOAD EXCEEDS REGISTERED WEIGHT PLUS TOLERANCE. THE DRIVER IS LEGALLY RESPONSIBLE IF THE AXLE WEIGHT ON HIS VEHICLE EXCEEDS THE PERMITTED MAXIMUM AXLE WEIGHT PLUS TOLERANCE. AXLE WEIGHT WILL BE CHECKED PERIODICALLY BY MOTOR VEHICLE INSPECTORS.**

The scale house sign is available from the Department Sign Shop at Truro as Number 05.

The truck driver is legally responsible to ensure that the legal axle limits plus tolerances are not exceeded.

If possible, the truck axles or axle groups should be weighed during the first several days of the trucking operation and the gross load should be near the permitted registered weight.

To assist the trucker in meeting the legal regulations Department weighers will:

**37.1 Initial Weighing of Axles.** Weigh axles or axle groups on each loaded vehicle once during the initial phase of the truck operation and advise the trucker of the axle loadings.

**37.2 Additional Weighing of Axles.** Following the initial axle weighing, subsequent weighing of axles will be done at the trucker's request. The trucker is to be advised accordingly.

**37.3 WEIGHING WILL BE PERMITTED UNDER THE FOLLOWING CONDITIONS:**

- **Single Weighing Procedure.** Prior to proceeding onto the scale platform, vehicles shall come to a complete stop. The vehicle shall then be driven onto the platform at a minimum speed and shall be gradually stopped centred on the platform. Before weighing, the brakes shall be released to insure there is no displacement of the scale components.
- **Split Weighing Procedures.** The practice of split weighing, for purpose of payment, is not permitted on Department contracts.

**38.0 TRUCK WEIGH SCALE**

**38.1 Contractors Responsibility to Supply Scales.** It is the Contractor's responsibility to supply, install and maintain in good working order, truck weigh scales approved for use by Industry Canada, Measurement

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Canada for weighing various materials such as gravels, asphalt concrete, rockfill, etc. on contracts or Department projects. All costs related to supply, installation and maintenance of scales shall be included in the unit price for the various materials to be weighed. Such scales will be tested occasionally by Industry Canada, Measurement Canada and/or the Engineer or his staff. The Contractor shall supply scales of sufficient length to accommodate weighing of all trucks, used on the contract, by the single weighing procedure.

The scale and scale house must comply with the requirements of the **Occupational Health and Safety Act and Regulations.**

**38.2 Contractors Responsibility to Supply Test Weights.** It is the Contractor's responsibility to supply, at his expense, 10,000 kg of certified test weights to carry out the necessary testing.

Test weights shall be inspected and certified for use by Industry, Canada, Measurement Canada at least once annually. The inspection shall be done prior to use of the weights in any particular year. If at any time it is suspected that the mass of the test weights has changed through damage or otherwise, they may be rejected by the Engineer until such time as they are re-certified. It is the Contractor's responsibility to make all arrangements and bear all costs with respect to the certification of the weights. The certification shall be carried out at facilities as specified by Industry Canada, Measurement Canada.

**38.3 Scale Beam Calibration.** The scale beam or other mass indicating device shall be calibrated in metric units, as frequent as required.

**38.4 Scale Testing and Certification.** All truck weigh scales shall be tested and certified by Industry Canada, Measurement Canada each year before being used. Arrangements for the testing will be made by the Engineer once the Engineer is advised by the Contractor that the scales are ready for inspection and test weights are available and the Engineer is satisfied that the scales are functioning properly. Normally, at two (2) week intervals during the period the scales are in use, Department personnel will perform reinspection of the scales. It will be the responsibility of the Contractor to provide personnel to handle test weights and to make adjustments if required during the testing procedure. The Contractor shall also make available a loaded tandem truck to be used during the test procedure, all at no cost to the Department.

Industry Canada, Measurement Canada may conduct unscheduled inspections at any time. If during the process of carrying out this unscheduled inspection, the scales are non-verified or seized due to measurement



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errors, a re-inspection and certification by Measurement Canada must be performed before the scales may be used for issuing weigh slips. All costs associated with having the scales re-inspected by Measurement Canada are at the Contractor's expense.

**38.5 Requirements Of Portable Scale Houses.** A weatherproof scale house shall be provided by the Contractor. It shall have a minimum floor area of 2.25 square metres, a ceiling height of 2.15 metres and a minimum of 0.91 metres free area measured from the back wall. Safe access via steps, etc. shall be provided to the doorway, which shall open outwards (access to meet all required codes). The door shall have a locking device and a key shall be provided to the weigher. The door shall be located on either of the walls perpendicular to the scale platform or the wall parallel to, and furthest from, the scale platform. Two sliding windows with screens shall be provided; one on the end of the scale house to provide a clear view of vehicles as they approach the scale platform; the other on the scale platform side of the scale house from which the weigher can transfer the weigh ticket to the truck driver. A storage area for a water container shall be provided (container and water shall be supplied by the Department) as well as an adequate stool and work surface for a ticket machine. Adequate heat and light sources shall be provided when required (both to meet all required codes). Toilet facilities must be readily available.

The floors of the scale house shall be insulated and the side walls shall be insulated if the scales are in use outside of the period May 15 to September 15. If dust is a problem, measures shall be taken to suppress it around the scale house or an adequate ventilation or filter system to handle dust shall be provided. Vehicles shall be weighed in such a manner that exhaust fumes are directed away from the scale house.

Before either the inspector from Industry Canada, Measurement Canada or the Engineer test the weigh scales for accuracy and performance characteristics, the scale and its installation shall be given a thorough inspection. The certification of scales will depend, in part, on the following conditions being met:

- The beam stand shall be rigid and supported to prevent springing under load and vibrating when a loaded vehicle drives onto the scale platform.
- The connecting rod between the weighbeam and the lever system shall be plumb and have ample clearance where it passes through the scale house floor.
- The various components of the weighbeam including pivots, bearings and beam notches shall be clean and free from rust and wear. The weight indication must be readable. The nibs, dogs or pawls shall engage positively in the beam notches. The balance

ball must be secured in position when the beam is brought to balance.

- The counter balance hangers shall not have loose material or easily removable weights hung from them.
- The scale operator must have an unobstructed view of the scale platform.

**38.6 Scale Deck.** The scale deck shall have an easy free floating movement with ample clearance at the ends and sides. The end walls or abutments shall be adequately separated to prevent displaced ramp materials from rolling into the pit and packing about the levers.

**38.7 Curb Rails and Guide Post System.** All scales used on Department contracts shall comply with the following:

- **Curb Rail.** Where the width of the scale platform permits, a curb rail system shall be installed on both sides of the platform.  
The curb rail system shall consist of either:
  - 200 mm x 200 mm timbers bullnosed on the inside or;
  - 200 mm high steel rail welded to the scale beam.
- **Single Rail and Guide Posts.** Where the width of the scale platform does not permit the installation of a curb rail system on both sides of the platform, a single rail shall be installed on the scale house side. Guide posts shall be installed on the other side.

If guide posts are used they shall be placed at both ends of the scale and aligned with the edge of the platform and preferably be constructed of minimum 75 mm diameter steel pipe or equivalent.

- **Guide Posts.** Where a scale house is located more than 3.7 m from an elevated scale platform, there shall be four guide posts installed at the corners of the scales as a guide for the truck drivers in lieu of a curb rail system.
- **Curb Rail Not Required.** Where the scale platform is flush with the ground level or other surfaces, a curb rail system is not required.

**38.8 Foundations.** Scales must be level at all times to operate properly. The type of foundation required will depend largely on the soil condition and length of time of intended use in that location.

Shims and other means of height adjustment shall be made of any suitable material that resists compression at least as well as the main support structure, and shall cover the entire area under the lever stands or load cell bases to ensure that the scale remains stable and level under normal conditions of use of the scale.

**38.9 Drainage.** Proper drainage of the area surrounding the pit shall be provided. This may require ditching or drainage tiles, etc. depending on the length

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of time the scale is to remain on the site. Water shall not be allowed to undermine the foundation. The area under the scale shall be free of all debris, old roots, sand, gravel, etc.

**38.10 Approach Ramps.** The approach ramp and off ramp shall be level (0 degree incline) for at least the length of the longest vehicle being weighed. The area under the approach ramps shall be free of all debris, old roots, sand, gravel, etc. and the ramps shall be firm and well compacted to prevent settling. The ramps shall be inspected regularly and any ruts or settlement corrected immediately.

**38.11 Lever System.** Levers must be in alignment, level and free of rust. The pivots and bearings must be clean, free of rust and wear. Anti-friction plates or caps or any other mechanical means used to limit side play or movement of knife edges in their bearings should be

replaced, if missing.

**38.12 Inspections, Tests, Allowable Tolerances.** After a thorough inspection of the scale components, either the inspector from Measurement Canada or the Engineer shall determine the accuracy of the scale. Scale tolerances and test weight requirements for certification shall be as illustrated in Table 1-4-1. Inspection shall involve the following tests:

- "zero balance"
- "sensitivity" (load discrimination)
- "preliminary performance" test which indicates the general condition of the scale and its installation.
- "strain load test"

**38.13 In General.** Any additional requirements contained in legislation will take precedent over requirements contained herein.

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**Table 1-4-1 AGREEMENT BETWEEN  
DEPARTMENT OF TRANSPORTATION & PUBLIC WORKS AND MEASUREMENT CANADA  
REGARDING SCALE TOLERANCES, IN SERVICE LIMITS OF ERROR**

| Verification scale interval                            | 2 kg           | 5 kg           | 10 kg            | 20 kg            |
|--------------------------------------------------------|----------------|----------------|------------------|------------------|
| In-Service LOE in Terms of Verification Scale Interval | Load in kg     | Load in kg     | Load in kg       | Load in kg       |
| 1                                                      | 0 - 1000       | 0 - 2500       | 0 - 5000         | 0 - 10000        |
| 2                                                      | +1000 - 2600   | +2500 - 6500   | +5000 - 13000    | +10000 - 26000   |
| 3                                                      | +2600 - 4200   | +6500 - 10500  | +13000 - 21000   | +26000 - 42000   |
| 4                                                      | +4200 - 5800   | +10500 - 14500 | +21000 - 29000   | +42000 - 58000   |
| 5                                                      | +5800 - 7400   | +14500 - 18500 | +29000 - 37000   | +58000 - 74000   |
| 6                                                      | +7400 - 9000   | +18500 - 22500 | +37000 - 45000   | +74000 - 90000   |
| 7                                                      | +9000 - 10600  | +22500 - 26500 | +45000 - 53000   | +90000 - 106000  |
| 8                                                      | +10600 - 12200 | +26500 - 30500 | +53000 - 61000   | +106000 - 122000 |
| 9                                                      | +12200 - 13800 | +30500 - 34500 | +61000 - 69000   | +122000 - 138000 |
| 10                                                     | +13800 - 15400 | +34500 - 38500 | +69000 - 77000   | +138000 - 154000 |
| 11                                                     | +15400 - 17000 | +38500 - 42500 | +77000 - 85000   | +154000 - 170000 |
| 12                                                     | +17000 - 18600 | +42500 - 46500 | +85000 - 93000   | +170000 - 186000 |
| 13                                                     | +18600 - 20200 | +46500 - 50500 | +93000 - 101000  | +186000 - 202000 |
| 14                                                     | +20200 - 21800 | +50500 - 54500 | +101000 - 109000 | +202000 - 218000 |
| 15                                                     | +21800 - 23400 | +54500 - 58500 | +109000 - 117000 | +218000 - 234000 |
| 16                                                     | +23400 - 25000 | +58500 - 62500 | +117000 - 125000 | +234000 - 250000 |
| 17                                                     | +25000 - 26600 | +62500 - 66500 | +125000 - 133000 | +350000 - 266000 |
| 18                                                     | +26600 - 28200 | +66500 - 70500 | +133000 - 141000 | +266000 - 282000 |
| 19                                                     | +28200 - 29800 | +70500 - 74500 | +141000 - 149000 | +282000 - 298000 |
| 20                                                     | +29800 - 31400 | +74500 - 78500 | +149000 - 157000 | +298000 - 314000 |
| 21                                                     | +31400 - 33000 | +78500 - 82500 | +157000 - 165000 | +314000 - 330000 |
| 22                                                     | + 33000        | +82500         | +165000          | +330000          |

The in-service limits of error that apply to a Class IIHD weighing device are  $\pm 1 e$  where the load is not less than zero and not more than 500 verification scale intervals, and where the load exceeds 500 verification

scale intervals, calculated by adding  $\pm 1 e$  for each additional 800 verification scale intervals or less, to a maximum of  $\pm 22 e$ .

**Division 1 General Requirements and Covenants****Section 4 General Provisions****39.0 CONDITION OF ROADS IMMATERIAL.**

Whenever it becomes necessary to transport the Contractor's plant, machinery or materials over roads adjacent to or leading to the work under this contract, the Contractor shall have no claim against the Minister for any cost or delays that may be incurred or occasioned by reason of the condition of said roads, or of any bridge or obstruction.

**40.0 PATENTED DEVICES, MATERIALS AND PROCESSES.**

The Contractor shall indemnify fully the Minister against all suits or actions arising from the claims of any person or persons who are, or claim to be, the patentees of any process used in connection with the work, or of any materials, plant machinery, tools or appliances, used therein, or thereon, or in any way in connection therewith.

**41.0 BORROW, GRAVEL AND PLANT MIX AGGREGATE PITS AND PLANT SITES.**

All excavation work carried on outside of normal highway embankments for the purpose of supplying common, rock, gravels, and plant mix aggregates, or for providing a hot mix plant site, shall be done under the direct supervision and with prior approval of the Engineer. Except in areas where it is impractical to do so, all such excavations shall not be visible from the Highway.

The work shall be carried out in such a way that all waste material from clearing, grubbing, screening, and material selection operations will be disposed of properly in a manner that will not present an unsightly appearance or endanger or pollute the adjacent lands, rivers, lakes, or other water courses.

On completion of the work, the perimeter of the area shall be uniformly sloped, all waste material including boulders, grubbing, asphalt spillage, etc., shall be properly disposed of and the entire excavation area shall be uniformly graded and adequately drained in preparation for possible future seeding by the Department, all in accordance with the Pit and Quarry Regulations in effect at the time of the award of the contract and to the satisfaction of the Engineer.

**42.0 LAND ACQUISITION.** At the time of award of a contract all the required right-of-way may not have been acquired by the Department. The Contractor is not permitted to work on any section of a contract until first obtaining permission from the Engineer. Delays in acquiring the necessary right-of-way by the Department shall not constitute a claim on the part of the Contractor for damages or for any loss of anticipated profits.

**43.0 PAYMENTS.** Cash payments equal to 90% of the total value as shown on the Financial (Progress Estimate) Report done, as valued by the Engineer, will

be made to the Contractor monthly, as the work progresses, on the written certificate of the Engineer that the work for, or on account of which the certificate is granted, has been duly executed to the Engineer's satisfaction, and stating the value of such work as computed by him, and the said certificate, shall be a condition precedent to the right of the Contractor to be paid the said percentage, or any part thereof. The Engineer may after the value of the work done exceeds one half the aggregate amount of the tender, increase the cash payments to 95% of the value of the work done. No such monthly payment shall be construed to be an acceptance of any defective work or improper materials. Whenever the work is finished, according to the plans and specifications the Engineer shall certify the final estimate which signifies that the work is done to his satisfaction. Subject to the other provisions of this contract the Minister will then pay to the Contractor within 60 days, but not before 30 days, after execution of the said final certificate the remainder which shall be found to be due, excepting therefore such sum or sums as may be lawfully deducted or retained under any of the provisions of the contract. The written certificate of the Engineer certifying to the final completion of the said work to his/her entire satisfaction shall be a condition precedent to the right of the Contractor to receive or to be paid the balance due, or any part thereof.

The right is reserved by the Minister to reject the whole or any part of the work, should the said certificate be found to be inconsistent with the terms of the contract, or otherwise improperly given.

The Engineer's progress certificates, and the payment of progress estimates based upon the same, shall not be construed an acceptance or approval of the work, but only as temporary advances to the Contractor. The Contractor shall be bound, notwithstanding such progress estimates, to well and truly complete, finish and hand over in good condition, and to the entire satisfaction of the Engineer, by the time specified and in accordance with the terms and conditions of the specification, the whole of the work included herein, and all the percentage retained by the Minister shall be retained by him, until the said full and satisfactory completion has been formally certified by the Engineer. No moneys payable, due or accruing under this contract shall be assigned without the consent in writing of the Engineer.

**44.0 ANNULMENT OF CONTRACT.** In case the Contractor shall make default or delay in commencing, or in diligently executing any of the works or portions thereof to be performed, or that may be ordered under this contract, to the satisfaction of the Engineer, the Engineer may give written notice to the Contractor requiring him to put an end to such default or delay.



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Should such default or delay continue for six days after such notice shall have been given by the Engineer to the Contractor, or should the Contractor make default in the completion of the works, or any portion thereof, within the time limited with respect thereto in or under this contract, or should the Contractor become insolvent, or abandon the work, or make an assignment of this contract without the consent required, or otherwise fail to observe and perform any of the provisions of the contract, then in any of such cases, the Minister without any further authorization, may take all the work out of the Contractor's hands and may employ such means as he may see fit to complete the works. In such case the Contractor shall have no claim for any further payment in respect of work performed, but shall be chargeable with and shall remain liable for all loss and damage which may be suffered by reason of such default or delay, or the non-completion by the Contractor of the works. No objection or claim shall be raised or made by the Contractor by reason, or on account of the ultimate cost of the works so taken over, for any reason proving greater than, in the opinion of the Contractor, it should have been, and all materials, articles, and things whatsoever, and all machinery, tools, plant and equipment, and all rights, proprietary or otherwise, licenses, powers and privileges, whether relating to or effecting real estate or personal property, acquired, possessed or provided by the Contractor for the purposes of the work, or by the Engineer under the provisions of this contract shall remain and be the property of the Minister for all purposes incidental to the completion of the works, and may be used, exercised and enjoyed by the Minister as fully to all intents and purposes connected with the works as they might therefore have been used, exercised and enjoyed by the Contractor. The Minister may also at his option, sell or otherwise dispose of, at forced sale prices, or at public auction or private sale, or otherwise, the whole or any portion or number of such materials, articles, things, machinery, tools, plant and equipment at such price or prices as he may see fit, and retain the proceeds of any such sale or disposition and all other amounts then or thereafter due to the Contractor on account of, or in part satisfaction of any loss or damage which the Minister may or may have sustained by reason aforesaid.

**45.0 OCCUPATIONAL HEALTH AND SAFETY ACT.**

It is mandatory on all Department contracts that the Contractor immediately report all incidents that have involved contact with electrical power lines, poles supporting electrical power lines, or other lines or poles that could impact electrical power lines to Nova Scotia Power Inc. and/or MTT as applicable and also the Department of Labour and the Department Supervisor for the project. If an accident occurs involving electrical power and/or communication lines, the Contractor shall appoint a representative to serve on a Joint Use

**Accident/Incident Investigation Committee.**

It shall be the Contractor's responsibility to become familiar with the requirements of the current Occupational Health and Safety Act of Nova Scotia and shall conduct his work so as to conform to the Act.

Copies of the Occupational Health and Safety Act and the Regulations may be purchased from the Nova Scotia Government Book Store, One Government Place, 1700 Granville Street, Halifax, N.S. B3J 2T3. Phone No. 424-7580 or 1-800-526-6575.

**46.0 BLASTING**

**46.1 Blasting Near Watercourses.** Blasting in or near watercourses shall receive approval from the Department of Fisheries and Oceans, and shall be in accordance with the "Guidelines for Use of Explosives in Canadian Fisheries Waters" (DFO; April 1993).

**46.2 Occupational Health and Safety and Other Regulations.** All blasting carried out on this project shall be in accordance with the Regulations made pursuant to the Occupational Health and Safety Act, Chapter 320 of the Revised Statutes of Nova Scotia. The requirements as set out in the Occupational Health and Safety Act are deemed to be minimum requirements and the Contractor shall conduct his operations in such a manner so as to comply with any and all other Act(s) or Regulations in effect at the time of blasting.

**46.3 Claims for Damages.** It shall be the responsibility of the Contractor to satisfy all claims for damages as a result of blasting.

**46.4 Public Notification.** The Contractor or his/her agent shall notify the general public through radio or news media that blasting will be taking place in a particular area and the anticipated duration of work should be specified.

**46.5 Prerequisites Required Before Blasting Permitted.** No blasting or use or storage of explosives shall be permitted on this project until the Contractor has provided proof of the following to the Engineer:

- That the blaster has a valid "Blaster's Certificate"
- That the Contractor has procured any blasting permit specific to the project required by any jurisdiction.
- That the Contractor has in effect, adequate insurance with reasonable deductible to cover any anticipated loss that may occur through claims or otherwise that may occur.
- That the Contractor has conducted a pre-blast survey of any structures in the area that may be affected by the blasting.



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The Contractor shall provide a copy of the blast design to the Engineer, if requested to do so by the Engineer, before a particular blast is made.

**46.6 Delays in Traffic / Damage to Pavement.** The Contractor shall ensure that the amount of rock that may be blown onto the existing pavement is minimized and that the time of blasting is such to provide minimum delays to the travelling public. The Contractor shall have adequate and appropriate equipment available

retain a qualified consultant to monitor ground vibration and air shock waves of all blasts. The monitoring results shall be provided to the Engineer within 48 hours of the blast or sooner, if requested by the Engineer.

**46.8 Magnitude of Blast.** Blasting is to be done in a manner that all three components of ground vibrations shall not exceed 12.5 mm/sec (0.5 in./sec) and air concussion as measured by peak over pressure shall not exceed 0.003 lbs/sq.in. or 128 decibels as measured in the ground adjacent to the nearest structure and any other structure where it is anticipated the values will be higher than at the nearest structure.

**46.9 Cost.** All costs associated with blasting as described herein shall be considered incidental to the

near the site of the blast to remove any rock that may be blown onto the roadway in such a manner to avoid damage to the pavement and, in a timely fashion, to minimize delays to traffic. The Contractor shall be responsible and satisfy all claims for damage to property of the Provincial Crown including, but not limited to, the roadway.

**46.7 Compliance Monitoring.** The Contractor shall

work involved with tender pay items such as, Solid Rock Excavation, Foundation Excavation Solid Rock, etc.

**47.0 REGULATIONS AND GUIDELINES CONTAINED IN APPENDIX B.** Regulations and guidelines contained in Appendix B are provided for information only. Procurement of the most current editions to these regulations and guidelines from the issuing authority is the responsibility of the Contractor. The Contractor shall conduct the work in accordance with said edition and/or the terms and conditions of the approvals granted by said authority. If there is a conflict, in the terms and conditions, between the approved guidelines and the actual permit, the more stringent conditions shall apply.

## Division 1 General Requirements and Covenants

## Section 5 Environmental Protection

## SECTION 5 - ENVIRONMENTAL PROTECTION

In general, the Nova Scotia Department of Transportation and Public Works (DOT&PW) is committed to the construction and maintenance of highways in a manner which is protective of the environment including maintaining water quality through erosion and sediment control, and minimizing disturbance to land use, wildlife and habitat.

**1.0 ENVIRONMENTAL PROTECTION.** It shall be the Contractor's responsibility to become familiar with the requirements of the current Environment Protection Act and shall therefore, conduct the contract work so as to conform to the Act.

- **Work Conformance.** All work shall conform to the "Nova Scotia Watercourse Alteration Specifications (1993) which can be found in Appendix B.
- **Contamination of Streams.** The Contractor shall refrain from any action that may cause contaminated run-off to reach lakes and streams.
- **Chemicals for Dust Control.** The Contractor shall not be permitted to use chemicals for dust control unless approved in writing by the Engineer.
- **Contractor Installations.** The Contractor shall not be permitted to construct machinery maintenance depots, refueling stations, storage yards, or any type of installation, as determined by the Engineer, that could possibly cause contamination to streams or lakes through the disposal of human waste, oil, grease or other deleterious material.
- **Contaminated Material.** Any material contaminated by the accidental spilling of fuel, anti-freeze, oil or grease that, in the judgement of the Engineer, may cause contamination to streams or lakes, shall be loaded and transported to an area where it can be disposed of in a manner approved by the Engineer, all at the expense of the Contractor.
- **Asphalt Concrete and Portland Cement Concrete.** The provincial Solid Waste - Resource Management Regulations do not regulate asphalt concrete and Portland cement concrete, however, when disposed of off-site, the waste disposal site is required to be approved by the municipality. No approvals are required if the material is disposed of within the Department's right-of-way (i.e. embankment fills). Where possible, the Project Engineer shall direct the Contractor to employ reasonable and practical means to dispose of asphalt concrete and Portland cement concrete within the highway right-of-way (ie embankments) so as to avoid materials from being directed to a Construction and Demolition Disposal site.

**2.0 POLLUTION CONTROL.** Prior to any grubbing being done, drainage and siltation control devices shall be installed as directed by the Engineer.

- **Water Flowing From Right-of-Way.** All water flowing from the highway right-of-way shall be filtered either by a settlement pond, sediment trap, or diverted to a culvert system, whichever is deemed necessary by the Engineer.
- **Flow Checks.** Flow checks shall be constructed across roadside drainage ditches throughout cut sections and adjacent to inlets and outlets of culverts, or as otherwise directed by the Engineer. Flow checks shall be placed so as to completely filter all roadway runoff prior to it entering local drainage streams.
- **Settlement Ponds.** Where larger flows of water or drainage areas are encountered, settlement ponds may be required. These ponds shall be of sufficient size to filter all runoff from the highway right-of-way to be drained. Settlement ponds shall be constructed where and as directed by the Engineer.

**3.0 BORROW AND GRAVEL PITS.** All borrow material and gravel pit or quarry aggregates shall be approved by the Nova Scotia Department of the Environment with respect to their acid production/consumption properties and the heavy metals contained. If an acid production/consumption test is required, the test shall be carried out using the B.C. Research Test method.

**4.0 MINERALIZED ROCK EXCAVATION.** Should mineralized rock be encountered on the contract, the "Guidelines for Development on Slates in Nova Scotia" prepared by the Nova Scotia Department of the Environment and Environment Canada, dated April 1991, and the Nova Scotia Department of Transportation and Public Works' "Approval Process for Pits Containing Slates" shall be followed. These documents may be obtained at the Highway Design Office, Department of Transportation and Public Works, Halifax, N.S., B3J 2N2 or may be picked up at that office located at Purdys Wharf II, 1969 Upper Water Street, Halifax, N.S.

**5.0 DISPOSAL OF SURPLUS BRUSH, SLASH OR NON-MERCHANTABLE TIMBER.** The Nova Scotia Department of Transportation and Public Works has developed guidelines for the disposal of surplus brush, slash or non-merchantable timber. Burning is permitted although other methods of disposal are encouraged. In all cases, disposal shall adhere to Federal, Provincial, and Municipal laws and regulations.

**5.1 Chipping.**

- Large piles are to be avoided.
- Chips are to be disposed of where they shall not run into a watercourse or block ditches, culverts, drains,

## Division 1 General Requirements and Covenants

## Section 5 Environmental Protection

etc.

- Chips are to be disposed as directed by the Engineer.

**5.2 Burning.**

- The use of tires and waste oil are prohibited
- A permit shall be obtained from the N.S. Department of Natural Resources. In addition, burning requires constant supervision and sufficient staff and equipment on hand to contain fire.
- Burning shall not be carried out within 100 m of houses.
- Burning may be carried out within 100 m of any travelled way only if the following conditions apply:
  - Smoke will not create a traffic hazard.
  - All other laws, regulations, and guidelines are followed.

**5.3 Municipal Land Fills.** Disposal in municipal land fills are as permitted by the municipality.

**5.4 Brush Cuttings.** If brush cuttings are light they may be left on the right-of-way (eg. clearing for additional visibility for a driveway). If brush cuttings are heavy and unsightly they shall be removed from the ROW.

**5.5 Burying.** In contract work brush (also stumps and roots) may be buried in pits and/or in the toe of slopes or outside the theoretical slope, and dressed, if approved by the Engineer.

**5.6 Work on 100 Series Highways.**

- **Twinning Projects.** If brush, slash, or non-merchantable timber is not buried then chipping shall be carried out to dispose of the material unless otherwise directed by the Engineer.

- **New Highways.** Burning is permitted. Chipping is recommended.

**6.0 WORK PROGRESSION SCHEDULE**

**6.1 Purpose.** The purpose of this clause is to ensure that construction in any work area is carried out continuously from initiation to completion to ensure orderly progression of the work, and to offer effective protection of the environment by minimizing exposed soil on construction sites.

**6.2 Work Areas.** A "work area" is an area, defined by station chainages, the limits of which shall be established by the Contractor prior to commencement of work. The size of the work area shall be determined by the Contractor's ability to complete all grading work, to the lines and grades shown on the plans, seeding and final slope protection **within 30 calendar days**. Work will commence with the start of grubbing in that work area, and will be considered complete when the specified cover material is applied (ie. straw/hay mulch, erosion control blanket, sod, clear stone, if required).

The work area shall be determined by the Contractor with the approval of the Engineer.

Grubbing work necessary for the installation of culverts is exempt from the Work Progression Schedule.

The placement of subgrade gravels on the subgrade shall not be considered a condition of the Work Progression Schedule unless required by Regulatory Agencies and specified in the Special Provisions.

The following table shall be completed and approved by the Engineer prior to commencement of any grubbing.

Table 1.5.1 - Work Areas - Work Progression

| Area # | Area bounded by |             |              | Timing constraints                          |                                                        |
|--------|-----------------|-------------|--------------|---------------------------------------------|--------------------------------------------------------|
|        | Station         | Offset Left | Offset Right | Time interval from commencement of contract | Timing Constraints (seasonal, based on approvals, etc) |
|        |                 |             |              |                                             |                                                        |
|        |                 |             |              |                                             |                                                        |
|        |                 |             |              |                                             |                                                        |

**6.3 Unforeseen Circumstances.** If conditions are encountered in one of the active work areas which requires extra care or work which the Contractor is unable to proceed with at that time, the Contractor will be allowed to open up additional work area(s) only after

the original work area is temporarily protected, ie., straw/hay mulch. Payment for temporary protection will be dependent on the circumstances and shall be at the discretion of the Engineer.

## Division 1 General Requirements and Covenants

## Section 5 Environmental Protection

If unforeseen circumstances occur, the 30 calendar day period may be extended. This shall be at the discretion of the Engineer. This extension must be accompanied by a written report outlining the need for the extension.

**6.4 Non-Compliance.** Once the grubbing operation within a specific work area has begun, the operation shall be continuous from grubbing through to the placement of seed (including fertilizer, lime) and final slope protection, if required. If after 30 calendar days the above described work is not completed, then the

Contractor will be considered in violation of the contract and work shall proceed in the following fashion:

- No additional work area(s) will be allowed to commence until the uncompleted work areas are completed,
- All work areas shall be immediately protected with straw/hay mulch at the Contractor's expense and at the discretion of the Engineer.

Table 1.5.2 Example Table

| Area # | Area bounded by |             |              | Timing constraints                                        |                                                                                |
|--------|-----------------|-------------|--------------|-----------------------------------------------------------|--------------------------------------------------------------------------------|
|        | Station         | Offset Left | Offset Right | Time interval from commencement of contract to completion | Permitted Time Period for Work                                                 |
| 1      | 2+750           | 0 - 40 m    |              | Day 1-30<br>June 20 - July 20                             | Commencement no earlier than June 1.<br>Completion no later than September 30. |
|        | 3+500           | 0 - 40 m    |              |                                                           |                                                                                |
| 2      | 3+800           | ROW limit   | ROW limit    | Day 20 - 50<br>July 10 - Aug 9                            | No constraint                                                                  |
|        | 4+900           | ROW limit   | ROW limit    |                                                           |                                                                                |
| 3      | 5+000           | ROW limit   | 30 - 50 m    | Day 25 - 55<br>July 15 - Aug 14                           | Commencement no earlier than June 1.<br>Completion no later than September 30. |
|        | 6+200           | ROW limit   | 30 - 50 m    |                                                           |                                                                                |
| 4      | 6+200           | ROW limit   | ROW limit    | Day 50 - 80<br>Aug 9 - Sept 9                             | Rock to be placed in lake only between Aug 15 and Sept 30.                     |
|        | 7+000           | ROW limit   | ROW limit    |                                                           |                                                                                |

If in the Engineer's judgement, there is non-compliance with erosion and sediment control provisions, then corrective action may require a shutdown of construction activities, until such time

as the non-compliance is corrected to the satisfaction of the Engineer. No claims by the Contractor will be entertained because of the shutdown of the project or a portion of the project.





## Division 2 Earthworks

## Section 1 Clearing

**SECTION 1 - CLEARING****1.0 DESCRIPTION**

Clearing shall consist of the cutting and disposal of all trees, brush, slashings and fallen timber. Areas to be cleared shall be indicated on the plans or designated by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 1 Section 5, Environmental Protection

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Merchantable timber shall be cut, salvaged and become the property of the Contractor. Salvaged material shall be removed from the right-of-way before the completion date of the contract.

**5.1 Clearing.** Clearing shall consist of removing or cutting of all trees within the right-of-way to the limits as directed by the Engineer. The maximum cut off height shall be 300 mm above the ground level or at such heights as approved by the Engineer. For the purpose of this provision all timber with a minimum butt diameter of 100 mm and a length of 2.5 m shall be considered as merchantable timber.

Following approved disposal of merchantable timber, the remaining non-salvageable material such as standing trees, brush, slashings, limbs and fallen branches shall be cut and disposed of by burning, chipping or burying as discussed in Division 1 Section 5.

If approved by the Engineer cutting and disposal of merchantable timber and non-salvageable material may proceed in areas where culverts and necessary environmental controls have yet to be installed.

**5.2 Special Clearing.** Special clearing shall apply in areas where the merchantable timber has been removed prior to the commencement of the contract. Clearing shall consist of removal of the remaining non-salvageable material such as standing trees, brush, slashings, limbs, fallen branches and other surface

litter. This material shall be cut and disposed of by burning, chipping or burying. The burning of rubber tires and waste oil to assist in the burning process, either on or off the right of way, is strictly prohibited. Before any burning is started, the Contractor shall obtain a permit from the Department of Natural Resources as discussed in Division 1 Section 5 of the Standard Specification.

**5.3 Removal of Isolated or Ornamental Trees.** Isolated or ornamental trees shall be as designated by the Engineer and shall be removed where and as directed. No trees shall be removed without the approval of the Engineer.

Removal of isolated or ornamental trees shall consist of the removal of the total tree including stumps and roots.

Removal shall be done by carefully excavating the tree and limiting damage to the surrounding property where appropriate.

**5.4 Relocation of Ornamental Trees or Shrubs.** Ornamental trees and shrubs shall be relocated as directed by the Engineer.

Relocation shall be done by carefully excavating the tree or shrub so as to keep intact as much of the root system as possible and relocating the tree or shrub in an excavation large enough to accommodate the root system.

The relocated trees or shrubs shall be carefully backfilled and tamped by hand with suitable material which may require the addition of water, peat moss, topsoil, fertilizer or sand as directed by the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The quantity of Clearing and Special Clearing to be paid for under this section shall be the number of hectares cleared determined by horizontal measurement. Removed or relocated ornamental trees and shrubs to be paid for under this section shall be measured as individual units.

**8.0 BASIS OF PAYMENT**

Clearing and Special Clearing will be paid for at the contract unit bid price per hectare. The unit bid price shall be full compensation for clearing the areas

**Division 2 Earthworks****Section 1 Clearing**

designated by the Engineer and shall include transportation of material to, and acquisition of, the approved disposal sites. The Contractor shall supply all equipment, plant, labour, tools and all incidentals necessary to complete the work.

Payment for removal of isolated trees and ornamental trees will be made at the contract unit price for each tree. This price shall be full compensation for removal and disposal of the tree, stump and roots including supply of all equipment, labour, tools and incidentals

necessary to complete the work.

Payment for relocation of ornamental trees or shrubs will be made at the contract unit price for each tree or shrub. This price shall be full compensation for relocation of the tree or shrub including supply of all equipment, labour, tools and incidentals necessary to complete the work.

**9.0 WARRANTY**

## Division 2 Earthworks

## Section 2 Grubbing

**SECTION 2 - GRUBBING****1.0 DESCRIPTION**

Grubbing shall consist of the removal and disposal of all stumps, roots, downed timber, embedded logs, humus, root mat and topsoil from areas of excavations and embankments or other areas as directed by the Engineer. Areas to be grubbed shall be indicated on the plans or designated by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 7 Section 8, Topsoil
- Division 7 Section 11, Water Control at Culvert Extensions or Installations

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Grubbing shall be carried out by either of the procedures defined as Grubbing or Special Grubbing. Unless otherwise directed by the Engineer, grubbing shall not be required under embankments of 1.5 m or more. Generally, the areas to be grubbed shall extend to a width of 2 m outside of excavation and embankment slope lines. In no case shall any portion of the debris resulting from grubbing be placed in or under embankments or along the top of excavations. Push-offs shall not be permitted.

For areas where the Engineer has specified that topsoil is to be salvaged refer to Division 7 Section 8 of these specifications.

Areas used for the disposal of material removed in the grubbing operation shall not obstruct, contaminate or cause siltation of any streams or impair the drainage of the area and shall be left in a condition satisfactory to the Engineer.

Grubbing of areas for the installation of drainage structures shall be as detailed in Division 7 Section 11 of these specifications.

**5.1 Grubbing.** Material resulting from the grubbing operation may be loaded and transported to a disposal area outside the right-of-way. The disposal area shall

be supplied by the Contractor and approved by the Engineer. If approved by the Engineer, the debris resulting from grubbing may be buried in pits beyond the toe of slope. No stumps, roots, embedded logs or other objectionable material shall be used to dress slopes.

**5.2 Special Grubbing.** Special Grubbing shall be carried out only on cultivated land or other barren land where no clearing is required. The Contractor shall provide areas for the disposal of the excavated material. The disposal areas shall be approved by the Engineer.

The Contractor shall haul the excavated material resulting from the Special Grubbing operation up to the free haul limit of 300 m to place this material within the right-of-way if so directed by the Engineer. 

Material resulting from the grubbing operation shall not be disposed of by windrowing within the right-of-way boundary.

If approved by the Engineer the excavated material resulting from Special Grubbing may be used to flatten the embankment slopes after the theoretical slope has been achieved.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The quantity of Grubbing and Special Grubbing to be paid for under this section shall be the number of hectares grubbed determined by horizontal measurement.

**8.0 BASIS OF PAYMENT**

Grubbing and Special Grubbing will be paid for at the appropriate contract unit price per hectare. The unit bid price shall be full compensation for grubbing the areas designated by the Engineer. Topsoil and other excavated material removed in the grubbing operation shall be paid for as Roadway and Drainage Excavation Common. The Contractor shall supply all equipment, plant, labour, tools, and incidentals necessary to complete the work.

Material resulting from Grubbing or Special Grubbing shall be transported to the disposal area at no extra cost to the Department.

**Division 2 Earthworks****Section 2 Grubbing**

The Contractor will not be paid overhaul for transportation of material resulting from the Grubbing or Special Grubbing operation where the material is transported to a disposal area provided by the Contractor whether inside or outside the right-of-way boundary.

The Contractor will be paid for overhaul, at the overhaul rates listed in Appendix C, where material resulting from the Special Grubbing operation is hauled over 600 m and placed within the right-of-way as directed by the Engineer.

**9.0 WARRANTY**

## Special Provision - Division 2 Earthworks

## Section 3 Roadway and Drainage Excavation

**SECTION 3 - ROADWAY AND DRAINAGE EXCAVATION****1.0 DESCRIPTION**

Roadway and Drainage Excavation shall consist of excavating, transporting or disposing of all materials taken from within the limits of the work except Borrow and other excavation not included in this specification. The work shall include all excavation necessary to construct or alter side ditches, offtake ditches, catchwater ditches and inlet or outlet ditches to drainage structures. The work shall also include the sloping and shaping necessary to prepare, alter, construct and complete embankments, shoulders, gutters, ditches, roadway and driveway intersections to the required alignment, grade and typical cross-sections shown as on the Plans or as directed by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 5, Borrow
- Division 2 Section 4, Disposal of Surplus Material
- Drawing HS201.DWG
- Drawing HS202.DWG

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

**5.1 General.** All suitable materials removed from the excavation shall be used as far as practicable in the construction of embankments as directed by the Engineer. All breakage and slides shall be removed by the Contractor and disposed of as directed. Ditches and waterways shall be excavated to the depth, width and grade as shown on the plans or as directed by the Engineer. No excavated material shall be wasted without the approval of the Engineer. When material is to be wasted it shall be disposed of as approved by the Engineer. During construction the ditches shall be maintained in such condition that the roadway will be well drained at all times.

**5.2 Solid Rock Excavation.** Solid Rock excavation shall consist of excavating and removing rock *insitu* and all Boulders measuring 1 m<sup>3</sup> or greater in volume. Subsurface boulders 1 m<sup>3</sup> or greater in volume are classified as Solid Rock and this quantity shall be

deducted from the Common Excavation quantity.

Within the limits of the area to be surfaced, Solid Rock excavation shall extend to 600 mm below the subgrade elevation shown on the Plans or as directed by the Engineer. No undrained pockets shall be left in the rock surface. A material satisfactory to the Engineer shall be used to backfill the roadway to the subgrade elevation. All loose or shattered fragments of rock shall be removed from the roadway slopes. Excavated rock or waste from the excavation shall not be left outside the tops of the roadway slopes. Where depth permits, Solid Rock Excavation shall be used to construct embankments, otherwise it shall be disposed of as approved by the Engineer.

**5.3 Swamp Excavation.** Swamp Excavation shall consist of the excavation and disposal of peat, black muck or humus encountered in swamp or marsh areas.

If approved by the Engineer, excavated swamp material may be disposed of within the right-of-way. Such material shall be trimmed and left in a neat condition to the approval of the Engineer. Backfill on the areas from which Swamp Excavation has been carried out shall consist of approved material, and such backfilling shall follow excavation operations as directed by the Engineer.

It shall be the responsibility of the Contractor to ensure that the full depth of swamp is removed. Test drilling may be carried out on fills where swamps have been removed and backfilled. Where drilling shows swamp material exists in or under the fill, the Contractor, at their own expense, shall remove all such materials to acceptable bottom and shall backfill the area with acceptable material.

**5.4 Common Excavation.** All excavated material other than Solid Rock or Swamp Excavation shall be classed as Common Excavation.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

**7.1 General.** The quantity to be paid for under this item shall be the number of cubic metres of excavated material as shown on the cross-section sheets between the original ground line, as cross-sectioned before grubbing operations have started, and the lines of the completed and accepted excavation as computed by the average end area method of computation.



**Special Provision - Division 2 Earthworks****Section 3 Roadway and Drainage Excavation**

In rock excavations, no payment will be made for material excavated beyond a defined plane outside the theoretical slopes except as detailed in Division 2 Section 5 of these specifications. The theoretical slopes shall be as indicated on the plans or as directed by the Engineer. The defined plane referred to shall be parallel to and 1 m (measured horizontally) from the theoretical slope.

In common excavations, no payment will be made for material excavated beyond a defined plane outside the theoretical slopes except as detailed in Division 2 Section 5 of these specifications. The theoretical slopes shall be as indicated on the plans or as directed by the Engineer. The defined plane referred to shall be parallel to and 0.5 m (measured horizontally) from the theoretical slope.

**7.2 Rock.** Whenever Solid Rock is encountered the Contractor shall strip the area of earth within the slopes and notify the Engineer in order that proper measurements or cross-sections may be made. No allowance will be made for Solid Rock excavated before such measurements or cross-sections have been made.

**7.3 Swamp Excavation.** The depth of Swamp Excavation shall be determined either by soundings taken before the swamp is excavated or by cross-sections taken after the swamp material is removed. All swamp material shall be removed from beneath the roadway embankment. The outer limit of the Swamp Excavation shall be as directed by the Engineer and shall be bounded by:

- lines extending vertically to the bottom of the swamp from the point where the theoretical slope line meets the top of the swamp, or
- lines extending vertically to the top of the swamp from the point where the theoretical slope line meets the bottom of the swamp, as shown on drawings HS201 and HS202.

**7.4 Other Common Excavation.** On paving, repaving and upgrading contracts the quantities excavated shall be computed by the average end area method. The area to be used for the computations shall be the greater of:

- the area shown on the cross-section sheets between the original position of the ground line before the ditching operation started and the lines of the completed and accepted excavation.
- an area determined by the width of the excavation measured horizontally on the cross-section at grade level by 300 mm in depth.

**8.0 BASIS OF PAYMENT**

**8.1 General.** Roadway and Drainage Excavation will be paid for under one of the following three classes:

- Solid Rock Excavation
- Swamp Excavation
- Common Excavation

The volume of Roadway and Drainage Excavation measured as provided above will be paid for at the contract unit price bid for Solid Rock Excavation, Swamp Excavation or Common Excavation, as the case may be, which prices shall be full compensation for the excavation, hauling (exclusive of overhaul), the formation of embankments (exclusive of compaction), trimming of slopes, disposal of surplus and waste materials, preparation and completion of subgrade, shoulders and roadway, and the furnishing of all equipment, tools, labour and incidentals necessary to complete the work, except the displacement of swamp by blasting which will be paid for as Extra Work.

**8.2 Overhaul General.** This item shall include the transportation of "Roadway and Drainage Excavation" to embankment sites or other selected points over distances exceeding and exclusive of the established free haul distance of 300 m. All costs up to the free haul distance shall be included in the contract unit price per cubic metre for the class of excavation involved.

Material taken from excavation and used in embankments and selected material, hauled a distance greater than 300 m, when so directed by the Engineer, shall be paid for at the Standard Overhaul Rates for excavation.

**8.2.1 Designated Overhaul.** It may be necessary to move selected "Roadway and Drainage Excavation" from a designated area to a designated embankment or other site as directed by the Engineer. In this instance overhaul beyond the 300 m free haul distance will be computed separately from cross sections taken before and after placement of the material. No allowance will be made for selected material moved before cross sections have been made.

**Haul**

|               |               |
|---------------|---------------|
| 300 - 599 m   | 600 - 899 m   |
| 900 - 1199 m  | 1200 - 1499 m |
| 1500 - 1799 m | 1800 - 3199 m |
| 3200 - 4799 m | 4800 - 6399 m |

**Special Provision - Division 2 Earthworks****Section 3 Roadway and Drainage Excavation**

**8.2.2 Ordinary Overhaul.** After proper deduction has been made for material placed within the free haul distance and selected material if any, the quantity of embankment excavation placed beyond the free haul distance of 300 m shall be classified as overhaul and calculated by the Mass Diagram Method.

These distances shall be measured along the centre-line of the main roadway which is under construction and any additional haul due to circuitry of travel will not be considered.

**9.0 WARRANTY**



## Division 2 Earthworks

## Section 4 Disposal of Surplus Material

**SECTION 4 - DISPOSAL OF SURPLUS MATERIAL****1.0 DESCRIPTION**

Surplus material includes all excavated material, unusable or otherwise, which is not required in the work.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 2, Grubbing
- Division 2 Section 3, Roadway and Drainage Excavation
- Division 2 Section 12, Foundation Excavation
- Division 2 Section 13, Foundation Excavation for Bridges

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Surplus material shall be used to uniformly widen embankments, flatten slopes or be deposited in such other areas and for such purposes as directed by the Engineer. No excavated material shall be wasted without the approval of the Engineer. When such material is to be wasted it shall be placed such that it presents a neat appearance and shall not adversely affect abutting property. In no case shall material be deposited above the grade of the completed roadway unless approved in writing by the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

The work prescribed in this section will not be paid for directly but shall be considered incidental to the Basis of Payment pertaining to Division 2 Sections 2, 3, 12 and 13.

**9.0 WARRANTY**





## Division 2 Earthworks

## Section 5 Borrow

## SECTION 5 - BORROW

## 1.0 DESCRIPTION

Borrow is the additional material required for embankment construction when there is insufficient useable material available from the excavation. Borrow shall consist of useable material and shall be secured outside or inside of the highway right-of-way as approved by the Engineer.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 1, Clearing
- Division 2 Section 2, Grubbing

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The Contractor shall notify the Engineer of all proposed sources of Borrow. The Contractor shall have received approval from the Engineer prior to using material from these sources.

## 4.0 MATERIALS

## 5.0 CONSTRUCTION METHODS

The lands and right-of-way required for all Borrow obtained outside the limits of the highway shall be furnished by the Contractor. The Borrow pits shall be cleared and grubbed at the Contractor's expense to the approval of the Engineer. Borrow pits shall be excavated to regular lines to permit accurate measurement. Borrow pits shall be left in a neat condition with uniform slopes and the area within the slopes suitably graded and drained to the approval of the Engineer.

**5.1 Side Borrow.** Side Borrow may be taken by the Contractor from areas immediately outside the theoretical roadway slopes in excavations only with the prior approval of the Engineer. Where such Side Borrow is taken the outer slopes shall be finished parallel to those specified for the outer slopes of the roadway or as approved by the Engineer. The Department will allow the Contractor to obtain suitable Side Borrow from within the limits of the highway right-of-way without charge. Clearing and grubbing within the highway right of way shall be as detailed in Division 2, Section 1 and Section 2, except that no payment will be made for clearing and grubbing of areas where Side

Borrow is taken.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

**7.1 Borrow Pits.** The quantity to be paid for under this section shall be the number of cubic metres of excavated Borrow material, as shown on the cross-sections, between the lines of the grubbed ground and the lines of the completed Borrow excavation. The volume of unusable boulders in Borrow pits shall be deducted from the volume of Borrow to be paid. Computation shall be by the average end area method. The Contractor shall notify the Engineer sufficiently in advance of Borrow removal to permit the measurement of the Borrow pit area. Any material removed from Borrow pits before such measurements have been made will not be paid for. If the Contractor excavates or places more Borrow material than is required, the quantity of material excavated in excess of the quantity required, shall be deducted from the amount of Borrow measured.

## 7.2 Side Borrow

**7.2.1 Side Borrow Approved Prior to Road Cut.** In areas where the Department has approved the acquisition of Side Borrow before the roadway excavation has begun, material removed beyond the theoretical slope shall be considered Side Borrow.

**7.2.3. Material Removed From the 0.5 m Overcut Plane.** In areas where the Department has not approved the acquisition of Side Borrow but some material was inadvertently removed beyond a plane parallel to and measured 0.5 m horizontally from the theoretical slope, and where the Department has benefited from the use of this material beyond the plane, then material removed beyond the plane will be considered Side Borrow. This would not apply in the case where the Contractor was advised before the material was removed that it would not be considered Side Borrow. 

**7.2.3 Side Borrow Approved After Road Cut.** In areas where the Department approves the acquisition of Side Borrow after removal of roadway excavation beyond the theoretical slope has begun, material removed beyond the actual excavation completed at the time of approval (but in no case inside the theoretical side slope) will be considered Side Borrow.

**Division 2 Earthworks**

**Section 5 Borrow**

**8.0 BASIS OF PAYMENT**

The volume measured as detailed above will be paid for at the contract unit price bid per cubic metre of Borrow, which price shall be full compensation for the clearing, grubbing, excavating, placing, site reclamation and the

furnishing of all materials, equipment, labour, and incidentals necessary to complete the work. No classification other than Borrow shall be allowed and only material placed in the work will be paid for.

**9.0 WARRANTY**

## Division 2 Earthworks

## Section 6 Subgrade

**SECTION 6 - SUBGRADE****1.0 DESCRIPTION**

In an embankment the Subgrade is defined as all approved material between the bottom of the excavation and the top of the completed embankment grade prior to the placement of gravels. In an excavation the Subgrade is defined as the compacted material below the approved grade, prior to the placement of gravels, to a depth of 300 mm.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 2, Grubbing
- Division 2 Section 3, Roadway and Drainage Excavation
- Division 2 Section 5, Borrow
- Division 2 Section 8, Compaction
- Division 2 Section 11, Fine Grading

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

After all unsuitable material has been removed and all drainage structures have been placed, the subgrade shall be constructed to the lines, grades and cross sections as shown on the plans or as approved by the Engineer. All excavation and compaction shall be carried out in accordance with Division 2 Sections 3 and 8.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

The work described under this section will not be paid for directly, but shall be considered as incidental to the Basis of Payment pertaining to Division 2 Sections 2, 3, 5, 8 and 11.

**9.0 WARRANTY**



## Division 2 Earthworks

## Section 7 Shoulders

**SECTION 7 - SHOULDERS****1.0 DESCRIPTION**

Shoulders shall be built and compacted to the lines, grades and cross-sections as shown on the contract drawings or as directed by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 3 Section 2, Gravel Type 1, 1S & 2
- Division 3 Section 5, Compaction of Gravels

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

Gravel for shoulders shall be Type 1S as detailed in Division 3 Section 2 or as approved by the Engineer.

**5.0 CONSTRUCTION METHODS**

Gravels shall be applied directly to the shoulders by means of an approved side delivery shoulder spreader. Spreading or placing by end dumping of gravels on the pavement shall not be permitted.

Compaction of gravel for shoulders shall be as detailed in Division 3 Section 5 or as approved by the Engineer.

Where the roadway is open to the public the gravelling of shoulders shall not fall behind the paving/repaving operation by more than 3 days or 5 km. At the end of the working week shouldering shall be within 3 km of the paving. Where the roadway is not open to the public the time and distance constraints noted above shall not apply unless directed by the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

The work described under this section will not be paid for directly but shall be included in the basis of payment items pertaining to Division 3 Section 2. Any material placed in Shoulders in excess of the quantities required will not be paid for and shall be removed at the Contractor's expense.

**9.0 WARRANTY**





## Division 2 Earthworks

## Section 8 Compaction

## SECTION 8 - COMPACTION

## 1.0 DESCRIPTION

Compaction is the work involved in consolidating to specified density material as placed in embankments and also that material at the top of subgrade in areas of excavation. The subgrade shall conform with the lines, grades, and cross-sections shown on the plans, or as directed by the Engineer after specified density has been obtained.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 698, Standard Proctor Test
- Division 2 Section 9, Water for Compaction & Dust Control

## 3.0 SUBMISSIONS AND DESIGN STANDARDS

## 4.0 MATERIALS

## 5.0 CONSTRUCTION METHODS

All material placed in subgrade shall be spread and bladed smooth in successive uniform layers, not to exceed 200 mm in compacted depth to the full width of the cross-section. Layers greater than 200 mm may be permitted by the Engineer providing specified density is obtained.

Embankments constructed principally of rock shall be placed in successive uniform loose layers not exceeding in depth the approximate average size of the larger rock, but limited to a maximum of 1 m. The maximum dimension of rock placed in the embankments shall not exceed 1 m. The rock shall not be dumped in place, but shall be distributed by suitable means within the embankment such that the interstices around the rock are filled with fine material.

Each layer shall be compacted to a minimum of 95% of the Standard Proctor dry density or the applicable Control Strip Density. The upper 300 mm of the subgrade shall be compacted in 150 mm layers to a minimum of 98% of the Standard Proctor dry density or the Control Strip Density. Unless otherwise approved by the Engineer, moisture content of the material shall be within  $\pm 2\%$  of its optimum moisture content as determined by Standard Proctor Density test.

Sidehill embankments may be constructed by dumping successive loads in uniformly distributed layers until the embankment is wide enough to permit the use of compaction equipment, after which the remainder of the embankment shall be compacted as specified.

When the original ground will not support the weight of the compaction equipment, the lower part of the embankment may be constructed by dumping successive loads in uniformly distributed layers of a thickness not greater than that necessary to support the equipment, after which the remainder of the embankment shall be compacted as specified.

**5.1 Test Methods.** All testing to ensure conformance to specification requirements shall be carried out by the Engineer or representative.

For material containing less than 30% oversize (retained on 20 mm sieve) the test method shall be Standard Proctor Test - ASTM D 698.

The maximum dry density for material containing more than 30% oversize shall be determined using the method prescribed herein as "Control Strip".

**5.2 Control Strip Method.** A Control Strip is a lift of material constructed on a 200 m section, minimum 3 m wide, of prepared surface selected by the Engineer. A maximum dry density, "Control density", shall be established on the lift of material using the equipment and method of compaction as prescribed herein for construction of a Control Strip.

A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed for each lift placed and also when any change in the character of the material, or any change in the compaction equipment used occurs. Each Control Strip is to remain in place and become a portion of the completed embankment.

To determine the Control Density, a minimum of six moisture and density tests shall be taken at random locations by the Engineer or representative, using a nuclear moisture density gauge. Test results shall be averaged to determine the in-place maximum dry density.

The maximum compacted thickness of each layer shall not exceed 200 mm except when it can be demonstrated, in construction of the Control Strip, that adequate compaction of thicker lifts is possible. The

**Division 2 Earthworks****Section 8 Compaction**

Control Density of lifts greater than 200 mm shall be equal to or greater than the Control Density of 200 mm layers. No additional lifts shall be placed until the control density is determined and required compaction is attained.

The Control Strip moisture content shall be adjusted to produce necessary compaction as directed by the Engineer. If the Control Strip compaction is being adversely affected by the moisture content of the soil, being either excessive or deficient, the Control Strip construction shall not continue until the moisture content is reduced or increased, to produce necessary compaction.

The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted. Minimum compaction equipment shall be vibratory steel rollers weighing not less than 6 t each and having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in the vibratory mode, and at a speed not exceeding 8 km/h.

**5.2.1 Control Density Determination.** A lift of material shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements for the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.

A "Pass" is defined as one complete coverage of the Control Strip layer with the compaction equipment. Testing of the Control Strip shall be discontinued when the average dry density between each series of passes:

- increases by less than 10 kg/m<sup>3</sup>
- continually decreases, or
- remains constant.

This maximum dry density shall be the Control Density used to determine the percent compaction in other

areas of the project of the same lift and thickness and of the same material as that used in the Control Section.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The quantity of compaction shall be the number of cubic metres of compacted material placed and accepted in embankments, determined from cross sections of the embankment, and computed using the average end area method of computation. The maximum measured quantity shall be that bounded by a plane 0.5 m horizontally beyond the theoretical embankment slope and parallel to the slope as accepted by the Engineer. The quantity of compaction in areas of excavation, where compaction of the top of the subgrade material is undertaken, shall be calculated based on the width multiplied by 300 mm depth below the top of the subgrade.

**8.0 BASIS OF PAYMENT**

The quantity of compaction as specified above, will be paid for at the contract unit price bid for compaction which price shall be full compensation for the work described in this section including the furnishing of all equipment, labour, materials and incidentals necessary to complete the work. No payment will be made for material placed beyond the plane measured 1m horizontally from the outside of the theoretical embankment slope.

When Common or Borrow material is placed in and across a body of water for the purpose of subgrade construction, no payment will be made for compaction of any materials lying below the surface of the water at the time the embankment is constructed.

**9.0 WARRANTY**

## Division 2 Earthworks

## Section 9 Water For Compaction and Dust Control

**SECTION 9 - WATER FOR COMPACTION & DUST CONTROL****1.0 DESCRIPTION**

Water for Compaction is water applied to gravels and material placed in embankments to facilitate consolidation to the specified density.

Water for Dust Control is water applied to the surface of the work to suppress dust.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 8, Compaction
- Division 3 Section 5, Compaction of Gravels

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

The quantity of water used for compaction shall not exceed that required to increase the moisture content of the material to optimum moisture condition.

Water for dust control shall be applied as directed by

the Engineer.

All equipment used for the application of water shall be equipped with pressure type distributors capable of uniform distribution of water and a positive means of shut-off. At least one mobile unit of not less than 4,500 L capacity for applying water shall be available for use on the project at all times and shall be retained on the project when requested by the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The quantity of Water for Compaction and Dust Control to be paid for under this section shall be the number of kilolitres utilized in the work.

**8.0 BASIS OF PAYMENT**

Water for Compaction and Dust Control will be paid for at the contract unit price per kilolitre. The price shall be full compensation for furnishing, handling, transporting and applying water, and for the supplying of all equipment, labour and incidentals necessary to complete the work herein specified.

**9.0 WARRANTY**





**SECTION 10 - ROUGH GRADING****1.0 DESCRIPTION**

Rough Grading shall consist of reshaping the existing roadway to a maximum depth of approximately 300 mm. This shall occur on sections of roadway where it is not practical to measure quantities of excavation by cross-sectioning.

**2.0 REFERENCES****3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Rough Grading the existing roadway may include scarifying, shaping, trimming, compaction and disposal of surplus material.

Examples of Rough Grading are:

- the removal of material from the inside of curves on paving contracts to correct the superelevation or;
- the removal of material to lower the grade on short sections where there is a bump in the profile.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The quantity of Rough Grading to be paid for under this section shall be the number of square metres of Rough Grading, based on horizontal measurements, prepared in accordance with the plans or as directed by the Engineer.

**8.0 BASIS OF PAYMENT**

Rough Grading will be paid for at the contract unit price per square metre for Rough Grading which price shall be full compensation for all scarifying, shaping, trimming, compaction and disposal of all surplus material and for the furnishing of all equipment, plant, labour and incidentals necessary to complete the work.

**9.0 WARRANTY**



## Division 2 Earthworks

## Section 11 Fine Grading

**SECTION 11 - FINE GRADING****1.0 DESCRIPTION**

Fine Grading shall consist of preparing previously graded subgrade or subbase for immediate placement of granular materials or pavements. The Contractor shall do all the grading to conform with the lines and grades as shown on the plans or as directed by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 8, Compaction
- Division 3 Section 2, Gravel Type 1, 1S & 2
- Division 3 Section 5, Compaction of Gravels

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Before any granular or paving materials are applied the subgrade or subbase shall be scarified, if necessary, shaped, trimmed and compacted to the lines and grades as directed by the Engineer. Compaction of the subgrade or subbase shall be accomplished with an approved roller as detailed in Division 2 Section 8 or Division 3 Section 5. All hollows and depressions shall be filled with acceptable material and compacted. Shaping, trimming, filling, and compacting shall continue until no depressions develop and the finished surface is smooth and uniform.

The final cross-section of the subgrade shall conform to the established grades within a tolerance:

- For Common or Borrow  $\pm 25$  mm
- For Rock Fill  $\pm 40$  mm
- For subbase refer to the corresponding gravel classification as detailed in Division 3 Section 2.

Prior to the placement of granular materials or paving materials the subgrade or subbase shall be prepared at least 1 km in advance or as directed by the Engineer.

The subgrade or subbase shall be kept continually and satisfactorily fine graded. Any surplus material resulting from the fine grading operations shall be used in building shoulders or if unsuitable for such purpose, shall be disposed of as directed.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The quantity of Fine Grading to be paid shall be the number of square metres, based on horizontal measurements, or as directed by the Engineer.

**8.0 BASIS OF PAYMENT**

Fine Grading will be paid at the contract unit price per square metre. The price shall be the full compensation for all scarifying, shaping, trimming, filling and rolling, handling, and disposal of all surplus material and for the furnishing of all equipment, labour and incidentals necessary to complete the work. Fine Grading shall not be paid more than once for any area. Fine Grading shall normally be paid for the full width of the roadway as prepared in cases 8.1., 8.2. and 8.3.

Fine Grading shall be paid only once on any one contract as per the following:

**8.1 Grading Contract.** For preparing the subgrade prior to the application of the initial gravel course.

**8.2 Combined Grading and Stabilization and/or Paving Contract.** For preparing the subgrade prior to the application of the initial gravel course.

**8.3 Stabilization and/or Paving Contract.** For the preparing the previously constructed gravel subbase prior to the application of any additional gravel courses.

**8.4 Final Paving and Paving of Shoulders.** For preparing the previously constructed gravel shoulders prior to the application of any additional gravels or paving courses.

**9.0 WARRANTY**



## Division 2 Earthworks

## Section 12 Foundation Excavation

**SECTION 12 - FOUNDATION EXCAVATION****1.0 DESCRIPTION**

Foundation Excavation shall consist of the removal of material for the construction of culverts, farm crossings and the laying of pipe, catch basins and retaining walls.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 4, Disposal of Surplus Material
- Drawing HS203.DWG

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Foundation Excavation shall conform to the lines and grades shown on the plans or as directed by the Engineer.

Boulders measuring 0.25 m<sup>3</sup> or greater, all rock insitu and masonry of old structures shall be classed as Foundation Excavation Solid Rock. All other excavated materials shall be classed as Foundation Excavation Common. The materials, so removed, shall be satisfactorily utilized or disposed of as directed by the Engineer.

After the excavation has been completed the Contractor shall notify the Engineer and no bedding material, masonry, pipe or other material shall be placed in the excavated area until the Engineer has approved the lines and grades of the excavation and character of the foundation material.

Where any structure including farm crossings, driveway

culverts and roadway culverts etc., are to be installed and when sufficient excavation has been carried out during grading operations, Foundation Excavation will not be allowed but the excavation will be classified as Roadway and Drainage Excavation. If additional excavation is required for installing any structure including farm crossings, driveway culverts and roadway culverts, etc., this additional excavation shall be classified as Foundation Excavation.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

All excavated material shall be measured in cubic metres in its original position provided such material has been satisfactorily utilized or disposed of as directed. The maximum limits for foundation excavation shall be 1 m beyond the concrete footing or pipe, measured horizontally at the bottom of the excavation, and extending at a 1 to 1 slope to the prefoundation excavation surface or as directed by the Engineer.

Measurement shall be based on the actual excavation carried out within the specified limits.

**8.0 BASIS OF PAYMENT**

The volume of Foundation Excavation measured as provided above will be paid for at the contract unit price bid per cubic metre for Foundation Excavation Common or Foundation Excavation Solid Rock, as the case may be. The volume of subsurface boulders paid as Foundation Excavation Solid Rock shall be deducted from the volume paid as Foundation Excavation Common. Payment shall be full compensation for the work described in this section, including all equipment, materials, labour, and incidentals necessary to complete the work.

**9.0 WARRANTY**





## Division 2 Earthworks

## Section 13 Foundation Excavation For Bridges

**SECTION 13 - FOUNDATION EXCAVATION FOR BRIDGES****1.0 DESCRIPTION**

Foundation Excavation for Bridges shall consist of the excavation for foundations of structures to the lines and grades as shown on the drawings or as directed by the Engineer. Where required, removal of existing bridge abutments and piers shall be considered as Foundation Excavation for Bridges.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 7 Section 9, Water Control for Bridge Foundations.

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Foundation Excavation shall be carried out in accordance with the drawings or as directed by the Engineer. The use of explosives or other means, which in the opinion of the Engineer might disturb existing structures, etc., shall not be permitted.

Boulders measuring 0.25 m<sup>3</sup> or greater, all rock in situ and masonry of old structures shall be classed as Foundation Excavation for Bridges Solid Rock. All other excavated materials shall be classed as Foundation Excavation for Bridges Common. The materials, so removed, shall be satisfactorily utilized or disposed of as directed by the Engineer.

If a cofferdam is required or deemed necessary by the Contractor, the Contractor shall submit a design for the cofferdam to the Engineer for review and approval. The design shall include the type of piling as well as the method proposed for dewatering and filling with concrete. Approval of the design shall be obtained before any construction is undertaken.

Should springs or flowing water occur in any part of the foundation area, a free and open channel shall be provided to allow the flow of water to discharge outside the limits of foundation to the satisfaction of the Engineer.

The disposition of excavated materials, usable or

otherwise, together with the provision of backfill, shall be carried out as approved by the Engineer. In the case of rock excavation, all loose and disturbed portions of the rock shall be removed and the exposed surface levelled, stepped or otherwise treated as directed by the Engineer.

After each excavation is completed, the Contractor shall provide notification to the Engineer so that an inspection of the work may be carried out. No concrete or permanent timber shall be placed until the depth of the excavation and the character of the foundation material have been approved. Elevations of bottoms of footings as shown on the plans are approximate only and the final elevations are to be approved by the Engineer. After removal of the forms, the excavations around structures shall be backfilled up to the level shown on the drawings or as otherwise directed. If approved, materials obtained from the foundation excavation may be used for backfilling, however, no fill shall be placed against any part of any structure until approved by the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

All excavated material shall be measured in cubic metres in its original position, provided such material has been satisfactorily utilized or disposed of as directed. The maximum limits for Foundation Excavation for Bridges shall be 1 m beyond the footing, measured horizontally at the bottom of the excavation, and extending at a 1 to 1 slope to the prefoundation excavation surface. No measurement for payment shall be made for excavated material moved more than once or required due to slides, cave-ins, silting, or filling due to the action of the elements or other causes.

Measurement shall be based on the actual excavation carried out within the theoretical limits.

**8.0 BASIS OF PAYMENT**

Foundation Excavation for Bridges measured as provided above, for work completed and accepted, will be paid for at the contract unit price for Foundation Excavation Bridges, Common; and Foundation Excavation Bridges, Solid Rock, as the case may be, which prices shall be full compensation for all the work prescribed under this section including all equipment, materials, labour, and incidentals necessary to complete the work, with the exception of cofferdams

**Division 2 Earthworks**

**Section 13 Foundation Excavation For Bridges**

and pumping which will be paid for as detailed in  
Division 7 Section 9.

**9.0 WARRANTY**

## Division 3 Granular Materials

## Section 1 Gravel Borrow

## SECTION 1 - GRAVEL BORROW

## 1.0 DESCRIPTION

When gravel or rock is specified for use in subbase, shoulders or for any other purpose for which the ordinary borrow is not permitted, such gravel or rock shall be classified as Gravel Borrow provided it is obtained outside of the slopes of the roadway. Gravel Borrow shall not be obtained from within the right-of-way without the approval of the Engineer.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 117, Test Method for Material Finer Than 75  $\mu$ m Sieve in Mineral Aggregate by Washing
- ASTM C 127, Test Method for Specific Gravity and Absorption of Coarse Aggregate
- ASTM C 136, Test Method for Sieve Analysis of Fine and Coarse Aggregate
- ASTM D 4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
- DOT&PW TM-1, Test Method for the Resistance of Coarse Aggregate to Degradation in the Micro-Deval Apparatus
- Division 1 Section 4, General Provisions
- Division 3 Section 5, Compaction of Gravels

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Gravel Borrow shall be composed of approved hard, durable stones and sand, particles in conformance with this specification.

**4.1 Gradation Requirements.** Gravel Borrow, when tested by ASTM C 117 and C 136, shall conform to the requirements as detailed in Table 3.1.1.

**4.2 Physical Properties.** Gravel Borrow shall conform to the physical properties listed in Table 3.1.2

Table 3.1.1 - Gradation

| Sieve Size $\mu$ m | Percent Passing |
|--------------------|-----------------|
| 112 000            | 100             |
| 14 000             | 15 - 65         |
| 80                 | 3 - 10          |

Table 3.1.2 - Physical Properties

| Property               | Test Method | Gravel Borrow |
|------------------------|-------------|---------------|
| Absorption, % maximum  | ASTM C 127  | 1.75          |
| Plasticity Index       | ASTM D 4318 | 0             |
| Micro-Deval, % maximum | DOT&PW TM-1 | 35            |

## 5.0 CONSTRUCTION METHODS

Gravel Borrow shall be placed in layers not to exceed 300 mm in thickness and shall be compacted to 98% of the Control Density using the Control Strip Method outlined in Division 3 Section 5.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

The Contractor shall, at their own expense, provide, install and maintain such approved scales and all suitable facilities as detailed in Division 1 Section 4 Subsection 39.

## 8.0 BASIS OF PAYMENT

Gravel Borrow will be paid for at the contract unit price per tonne for Gravel Borrow. The price shall be full compensation for furnishing all materials, equipment, and labour required to carry out the excavating, handling, hauling, placing and compacting of the Gravel Borrow.

## 9.0 WARRANTY





## Division 3 Granular Materials

## Section 2 Gravel Type 1, 1S &amp; 2

## SECTION 2 - GRAVEL TYPE 1, 1S &amp; 2

## 1.0 DESCRIPTION

Gravel Type 1, Type 1S and Type 2 shall be composed of crushed and screened rock or gravel. The material shall be transported and placed upon the subgrade, subbase or shoulder and compacted as directed and in accordance with these specifications.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 117, Test Method for Material Finer Than 75 µm Sieve in Mineral Aggregate by Washing
- ASTM C 127, Test Method for Specific Gravity and Absorption of Coarse Aggregate
- ASTM C 136, Test Method for Sieve Analysis of Fine and Coarse Aggregate
- ASTM D 4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
- DOT&PW TM-1, Test Method for the Resistance of Coarse Aggregate to Degradation in the Micro-Deval Apparatus
- DOT&PW TM-3, Test Method for the Determination of Percent Fractured Particles in Processed Coarse Aggregate
- Division 1 Section 4, General Provisions
- Division 3 Section 5, Compaction of Gravels

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Gravel shall be composed of approved hard, durable stones and sand particles in conformance with this specification.

**4.1 Gradation Requirements.** The gravels shall be free from flat, elongated or other objectionable pieces and shall be approved by the Engineer prior to utilization. The gravels shall be tested in accordance with ASTM C 117 and C 136 and shall fulfil the gradation requirements detailed in Table 3.2.1.

Table 3.2.1 - Gradation

| Sieve Size, µm | Percent Passing      |                       |                      |
|----------------|----------------------|-----------------------|----------------------|
|                | Type 1               | Type 1S               | Type 2               |
| 80 000         |                      |                       | 100                  |
| 56 000         |                      |                       | 70 - 100             |
| 28 000         |                      |                       | 50 - 80              |
| 20 000         | 100                  | 100                   |                      |
| 14 000         | 50 - 85              | 50 - 85               | 35 - 65              |
| 5 000          | 20 - 50              | 30 - 55               | 20 - 50              |
| 160            | 5 - 12               | 7 - 20                | 5 - 12               |
| 80             | 3 - 5 <sup>(1)</sup> | 5 - 12 <sup>(2)</sup> | 3 - 5 <sup>(1)</sup> |

<sup>(1)</sup> Where percentages passing the 5000 µm sieve are between 20 and 35%, the allowable percentage passing the 80 µm sieve shall be 3 to 8%.

<sup>(2)</sup> Where percentages passing the 5000 µm sieve are between 30 and 45%, the allowable percentage passing the 80 µm sieve shall be 3 to 12%.

**4.2 Fractured Particles Content.** The gravel shall have a fractured particle content conforming to values listed in Table 3.2.2. The fractured particle shall have at least one well defined fresh face resulting from fracture, with the face comprising no less than 20% of the particle surface area. Particles with smooth faces and rounded edges, or with only small chips removed, are not considered fractured.

Table 3.2.2 - Fractured Particles

| Gravel                | Fractured Particles, one face, % min. | Test Method |
|-----------------------|---------------------------------------|-------------|
| Type 1 <sup>(1)</sup> | 80                                    | DOT&PW      |
| Type 1 <sup>(2)</sup> | 50                                    | DOT&PW      |
| Type 2 and 1S         | 50                                    | DOT&PW      |

## Division 3 Granular Materials

## Section 2 Gravel Type 1, 1S &amp; 2

- (1) For highways with truck (FHWA Class 4 or above) traffic equal to or greater than 200 per day.
- (2) For highways with less than 200 trucks (FHWA Class 4 or above) per day.

**4.3 Physical Properties.** Gravel materials shall conform to the physical properties listed in Table 3.2.3.

**Table 3.2.3 - Physical Properties**

| Property           | Test Method | Type 1 | Type 1S | Type 2 |
|--------------------|-------------|--------|---------|--------|
| Absorption % max.  | ASTM C 127  | 1.75   | 1.75    | 1.75   |
| LA Abrasion % max. | ASTM C 131  | 40     | 40      | 40     |
| Plasticity Index   | ASTM D 4318 | 0      | 0       | 0      |
| Micro-Deval % max. | DOT&PW      | 20     | 35      | 20     |

### 5.0 CONSTRUCTION METHODS

Crushing, screening and transporting of materials shall be performed by such methods so that a uniform grade of material shall be placed on the roadbed. Screening shall be done with vibrating or rotary screens to eliminate all objectionable material such as earth, sod, foreign vegetable matter, clay or any excess of silt in the gravel. Prior to the placement of Gravel Type 2 or Type 1, the existing subgrade or subbase shall be shaped to the required cross-section to the approval of the Engineer.

Gravels Type 1, Type 1S and Type 2 shall be compacted as specified in Division 3 Section 5 and shall be shaped with a blade grader while being compacted. The shaping of the material shall be continued until it is well compacted, free from ruts, waves and undulations. The final authorized cross-section shall conform to the established grades within a tolerance of  $\pm 25$  mm for Gravel Type 2 and  $\pm 10$  mm for Gravel Type 1 but not uniformly high or low.

Stockpiles shall be built in layers not to exceed 1 m in depth. Each layer shall be completed before beginning the next layer. Aggregates delivered to the stockpile in trucks shall be uniformly spot-dumped and the stockpile built as specified above. Coning of stockpiles shall not be permitted.

**5.1 Inspection.** The Department will have a

representative at the site of gravel production. The Contractor is responsible to provide free and safe access to the site to permit the Department's representative to carry out required duties.

The Contractor shall supply an inspection facility at the gravel production site for the Department's representative and at the Contractor's expense. The location of this facility shall be close to the production site which allows a clear view of the operation and shall be in an environmentally acceptable area. At the gravel production site, a reservoir of 100 L. of water suitable for performing tests shall be supplied.

#### 5.1.1 Inspection Quarters - Aggregate Production Facility.

- outside dimension 2 m x 2 m minimum
- one door
- one window
- one bench
- one chair
- supply of water for testing purposes
- source of heat and/or light (if required)

### 6.0 QUALITY CONTROL / QUALITY ASSURANCE

#### 7.0 METHOD OF MEASUREMENT

The Contractor shall, at their own expense, provide, install and maintain such approved scales and all suitable facilities as detailed in Division 1 Section 4 Subsection 38.

The quantity of Gravels Type 1, Type 1S and Type 2 placed in stockpile as indicated above, will be estimated by the Engineer.

#### 8.0 BASIS OF PAYMENT

Gravels Type 1, Type 1S and Type 2 will be paid for at the contract unit price per tonne for Gravels. The price shall be full compensation for furnishing all materials, equipment, and labour required to carry out the handling, hauling, placing and compacting of the Gravels as well as any incidentals necessary to complete the work.

Gravels Type 1, Type 1S and Type 2 placed in stockpile as indicated above will be paid for at the current rate as indicated in Appendix C.

When such materials in stockpile have been placed on the highway the Contractor shall be paid at the unit price bid for such materials and the payments for such materials in stockpile shall be deducted and shown as a minus quantity on the estimate sheet. Any gravel left

**Division 3 Granular Materials**

**Section 2 Gravel Type 1, 1S & 2**

in stockpile and not used on the highway will not be paid for and shall remain the property of the Contractor.

when such materials cannot be placed on the highway commencement of crushing such material.

The Contractor may be paid for gravels in stockpile

**9.0 WARRANTY**



## Division 3 Granular Materials

## Section 3 Iron Blast Furnace Slag

## SECTION 3 - IRON BLAST FURNACE SLAG

## 1.0 DESCRIPTION

Iron Blast Furnace Slag (BFS) Type 1, Type 1S and Type 2 shall be composed of crushed and screened Iron Blast Furnace Slag. The material shall be transported and placed upon the subgrade, subbase or shoulder and compacted as directed and in accordance with these specifications.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 117, Test Method for Material Finer Than 75µm Sieve in Mineral Aggregate by Washing
- ASTM C 125, Terminology Relating to Concrete and Concrete Aggregates
- ASTM C 136, Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
- DOT&PW TM-1, Test Method for the Resistance of Coarse Aggregate to Degradation in the Micro-Deval Apparatus
- Division 1 Section 4, General Provisions
- Division 3 Section 5, Compaction of Gravels

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Materials for BFS Type 1, Type 1S and Type 2 shall be the non-metallic product consisting essentially of silicates and aluminosilicates of lime and other bases which is developed in a molten condition simultaneously with iron in a blast furnace as referenced in ASTM C 125.

**4.1 Gradation Requirements.** The BFS shall be free from deleterious materials shall be approved by the Engineer prior to utilization. The BFS shall be tested in accordance with ASTM C 117 and C 136 and shall fulfill the gradation requirements listed in Table 3.3.1.

**4.2 Physical Properties.** BFS materials shall conform to the physical properties listed in Table 3.3.2.

Table 3.3.1 - Gradation

| Sieve Size, µm | Percent Passing |         |        |
|----------------|-----------------|---------|--------|
|                | Type 1          | Type 1S | Type 2 |
| 80 000         |                 |         | 100    |
| 56 000         |                 |         | 70-100 |
| 28 000         |                 |         | 50-80  |
| 20 000         | 100             | 100     |        |
| 14 000         | 50-85           | 50-85   | 35-65  |
| 5 000          | 20-50           | 30-55   | 20-50  |
| 160            | 5-12            | 7-20    | 5-12   |
| 80             | 3-8             | 5-12    | 3-8    |

Table 3.3.2 - Physical Properties

| Property            | Test Method | Type 1 | Type 1S | Type 2 |
|---------------------|-------------|--------|---------|--------|
| Plasticity Index    | ASTM D 4318 | 0      | 0       | 0      |
| Micro-Deval, max. % | DOT&PW TM-1 | 25     | 35      | 25     |

## 5.0 CONSTRUCTION METHODS

Crushing, screening and loading of materials shall be performed by such methods that a uniform grade of material shall be placed on the roadbed. Prior to placement of BFS Type 2 or Type 1, the existing subgrade shall be shaped to the required cross-section to the approval of the Engineer.

BFS Type 1, Type 1S and Type 2 shall be compacted as detailed in Division 3 Section 5 and shall be shaped with a blade grader while being compacted. The shaping of the material shall be continued until it is well compacted, free from ruts, waves and undulations and the final authorized cross-section shall be to the established grades within a tolerance of  $\pm 25$  mm for BFS Type 2 and  $\pm 10$  mm for BFS Type 1 but not uniformly high or low.



**Division 3 Granular Materials****Section 3 Iron Blast Furnace Slag**

Stockpiles shall be built in layers not to exceed 1 m in depth. Each layer shall be completed before beginning the next layer. Aggregates delivered to the stockpile in trucks shall be uniformly spot-dumped and the stockpile built as specified above. Coning of stockpiles shall not be permitted.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The Contractor shall, at their own expense, provide, install and maintain such approved scales and all suitable facilities as detailed in Division 1 Section 4 Subsection 39.

The quantity of BFS Type 1, Type 1S and Type 2 placed in stockpile as indicated above, will be estimated by the Engineer.

**8.0 BASIS OF PAYMENT**

BFS Type 1, Type 1S and Type 2 will be paid for at the contract unit price per tonne for Gravels. The price shall

be full compensation for furnishing all materials, equipment, and labour required to carry out the excavating, handling, hauling, placing and compacting of the BFS Gravel.

BFS Type 1, Type 1S and Type 2 placed in stockpile as indicated above will be paid at the current rates as indicated in Appendix C.

When such materials in stockpile have been placed on the highway the Contractor shall be paid the unit price for such materials and the payments for such materials in stockpile shall be deducted and shown as a minus quantity on the estimate sheet. Any aggregate left in stockpile and not used on the highway will not be paid for and shall remain the property of the Contractor.

The Contractor may be paid for BFS aggregate in stockpile when such materials cannot be placed on the highway within a period of two months from the date of commencement of crushing such material.

**9.0 WARRANTY**

## Division 3 Granular Materials

## Section 4 Clear Stone

## SECTION 4 - CLEAR STONE

## 1.0 DESCRIPTION

Clear Stone C1 to C5 shall be composed of crushed or uncrushed, screened rock. Clear Stone is normally specified for use as drainage enhancement, flow checks or slope protection.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 117, Test Method for Material Finer Than 75  $\mu\text{m}$  Sieve in Mineral Aggregate by Washing
- ASTM C 127, Test Method for Specific Gravity and Absorption of Coarse Aggregate
- ASTM C 136, Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
- DOT&PW TM-1, Test Method for the Resistance of Coarse Aggregate to Degradation in the Micro-Deval Apparatus
- Division 3 Section 5, Compaction of Gravels
- Division 1 Section 4, General Provisions

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Materials for Clear Stone shall consist of hard, durable stone particles, in conformance with this specification.

**4.1 Gradation Requirements.** The stone shall be free from flat, elongated or other objectionable pieces and shall be approved by the Engineer prior to utilization. The gravels shall be tested in accordance with ASTM C 117 and C 136 and shall fulfil the gradation requirements listed in Table 3.4.1.

**4.2 Physical Properties.** Clear Stone aggregates shall conform to the properties listed in Table 3.4.2.

## 5.0 CONSTRUCTION METHODS

Crushing, if required, screening and transporting of materials shall be performed by such methods that a uniform grade of material will be placed on the roadbed. If directed by the Engineer Clear Stone shall be compacted as detailed in Division 3 Section 5 except the Control Strip may have to be modified as directed by the Engineer.

Table 3.4.1 - Gradation

| Sieve Size, mm | Percent Passing |        |        |        |        |
|----------------|-----------------|--------|--------|--------|--------|
|                | C1              | C2     | C3     | C4     | C5     |
| 250            | 100             |        |        |        |        |
| 200            |                 | 100    | 100    |        |        |
| 150            | 20-35           | 90-100 | 90-100 |        |        |
| 112            |                 | 0-10   | 20-35  | 100    |        |
| 80             |                 |        | 0-20   | 90-100 |        |
| 56             | 0-10            |        |        |        |        |
| 40             |                 |        |        |        |        |
| 28             |                 |        |        | 0-10   | 100    |
| 20             |                 |        | 0-10   |        | 90-100 |
| 14             |                 |        |        |        |        |
| 10             |                 |        |        |        | 0-40   |
| 5              |                 |        |        |        | 0-10   |

Table 3.4.2 - Physical Properties

| Property            | Test Method | Class C1 to C5 |
|---------------------|-------------|----------------|
| Absorption, % max.  | ASTM C 127  | 1.75           |
| Plasticity Index    | ASTM D 4318 | 0              |
| Micro-Deval, % max. | DOT&PW TM-1 | 25             |

Stockpiles shall be built in layers not to exceed 1 m in depth. Each layer shall be completed before beginning the next layer. Materials delivered to the stockpile in trucks shall be uniformly spot-dumped and the stockpile built as specified above. Coning of stockpiles shall not be permitted.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**Division 3 Granular Materials****Section 4 Clear Stone****7.0 METHOD OF MEASUREMENT**

The Contractor shall, at their own expense, provide, install and maintain such approved scales and all suitable facilities as detailed in Division 1 Section 4 Subsection 39.

The quantity of Clear Stone placed in stockpile as indicated above will be estimated by the Engineer.

**8.0 BASIS OF PAYMENT**

Clear Stone will be paid for at the contract unit price per tonne for Clear Stone. The price shall be full compensation for furnishing all materials, equipment and labour required to carry out the excavating, handling, hauling, placing and compacting of the Clear Stone.

When such materials have been placed on the highway the Contractor shall be paid the unit price for such materials and the payments for such materials in stockpile shall be deducted and shown as a minus quantity on the estimate sheet. Any aggregate left in the stockpile and not used on the highway will not be paid for and shall remain the property of the Contractor.

The Contractor may be paid for stone in stockpile when such materials cannot be placed on the highway within a period of two months from the date of commencement of crushing such material.

Clear Stone placed in stockpile as indicated above will be paid at the current rates as indicated in Appendix C.

**9.0 WARRANTY**

## Division 3 Granular Materials

## Section 5 Compaction of Gravels

## SECTION 5 - COMPACTION OF GRAVELS

## 1.0 DESCRIPTION

Gravels Type 1, Type 1S, Type 2, BFS and Clear Stone (if directed by the Engineer) shall be placed and compacted to a minimum of 100 % maximum dry density attained using the method prescribed herein as "Control Strip". The shaping of the material shall be continued until it is well compacted, free from ruts, waves and undulations.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 9, Water for Compaction & Dust Control
- Division 3 Section 2, Gravel Type 1, 1S & 2

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

## 5.0 CONSTRUCTION METHODS

**5.1 Control Strip Method.** A Control Strip is a lift of granular base course constructed on a 200 m section, minimum 3 m wide, of prepared surface selected by the Engineer. A maximum dry density "Control Density" shall be established on the lift of granular base course using the equipment and method of compaction as prescribed herein for construction of a Control Strip.

A Control Strip shall be constructed at the beginning of work. One or more Control Strips shall be constructed whenever a change is made in the type or source of material or any change in the compaction equipment used. The thickness shall be the same as for the completed courses in the pavement section. Each Control Strip shall remain in place and become a portion of the completed base course. No additional lifts shall be placed until the control density is determined and the compacted lift is approved by the Engineer. The Control Strip moisture content shall be adjusted to produce necessary compaction as directed by the Engineer. The surface of the granular base course shall be kept moist until testing is complete.

To determine the Control Density, a minimum of six

moisture and density tests shall be taken at random locations by the Engineer, using nuclear equipment. Test results shall be averaged to determine the in-place maximum dry density.

The type and mass of the compaction equipment used shall be such that uniform density is obtained throughout the depth of the layer being compacted. Minimum compaction equipment shall be a vibratory steel roller(s) weighing not less than 6 t, having a vibratory capacity of at least 1500 VPM with a minimum dynamic or centrifugal force of 8000 kg, operated in the vibratory mode, and at a speed not exceeding 8 km/h.

**5.2 Control Density Determination.** A lift of granular base course shall be spread over the entire Control Strip section. Once the Control Strip lift has been completely spread, the measurements for the Control Density shall commence and continue during repeated passes of the compaction equipment until a maximum dry density is achieved.

A "Pass" shall be one complete coverage of the Control Strip layer with the compaction equipment.

Testing of the Control Strip shall be discontinued when the average dry density between each series of passes :

- increases by less than 10 kg/m<sup>3</sup>,
- continually decreases, or
- remains constant.

This maximum dry density shall be the Control Density used to determine the percent compaction in other areas of the project for the same lift and thickness and same class of gravel as that used in the Control Section.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

## 8.0 BASIS OF PAYMENT

Payment for compaction shall be considered incidental to the supply of gravels as detailed in Division 3 Section 2.

## 9.0 WARRANTY





## Division 3 Granular Materials

## Section 6 Loose Laid Rip Rap

**SECTION 6 - LOOSE LAID RIP-RAP****1.0 DESCRIPTION**

Where required, Loose Laid Rip-Rap shall be laid to the lines and thickness as called for on the Plans or as directed.

**2.0 REFERENCES****3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

Field or quarry stone of approved quality and size shall be used.

**5.0 CONSTRUCTION METHODS**

The stone may be dumped from vehicles and allowed to roll into place.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The stone shall be measured in cubic metres in place, unless it is not practicable to so measure it, in which case it may be measured in vehicles.

**8.0 BASIS OF PAYMENT**

The quantities measured as herein specified shall be paid for at the unit price bid, which shall include the preparation of foundation, furnishing materials and the use of equipment, labour, tools, and other incidental expenses necessary to complete the work. Where material used for Loose Rip-Rap is produced as a result of excavation from roadway, it shall not be paid for as Loose Laid Rip-Rap. Payment will be made as Roadway and Drainage Excavation.

**9.0 WARRANTY**



## Division 3 Granular Materials

## Section 7 Hand Laid Rip-Rap

**SECTION 7 - HAND LAID RIP-RAP****1.0 DESCRIPTION**

Hand Laid Rip-Rap shall consist of stone carefully placed as slope protection in a non-aquatic environment. Where required, Hand Laid Rip-Rap shall be laid to the lines and thickness as called for on the plans or as directed by the Engineer. Stones shall be as large a size as procurable and consistent with dimensions of the wall. They shall be approximately rectangular with the two surfaces which will become the top and bottom of the stones when placed in the wall being approximately flat and parallel.

**2.0 REFERENCES****3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Before laying Rip-Rap, the face of the bank shall be dressed off evenly to receive the stones. The bottom course shall be firmly bedded to insure firm foundation and shall, if the Engineer deems necessary, commence in a trench below the toe of the slope.

Where necessary, the stones shall be roughly hammer dressed and shall be laid normal to the face of the wall.

Joints shall be broken and not less than 75% of the stones shall be headers going entirely through the wall. The interstices between larger stones shall be fitted with smaller stones hammered in.

The wall thickness and depth shall conform to the lines provided by the Engineer. The minimum wall thickness shall be 400 mm. Stones shall be placed to the satisfaction of the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The Rip-Rap shall be measured in cubic metres in place. The volume of void created by the existence of a drainage or other structure shall not be included in the volume of Rip-Rap for payment.

**8.0 BASIS OF PAYMENT**

The quantities measured as herein specified will be paid for at the unit price bid per cubic metre for Hand Laid Rip-Rap, which price shall be full compensation for the preparation of foundation, furnishing materials and the use of equipment, labour, tools, and other incidental expenses necessary to complete the work.

**9.0 WARRANTY**



## Division 3 Granular Materials

## Section 8 Armour Rock

## SECTION 8 - ARMOUR ROCK

## 1.0 DESCRIPTION

Armour Rock shall be used as a protective barrier from erosion for slopes in an aquatic environment.

The thickness of the Armour Rock layer shall normally vary from 1.0 to 1.5 times the maximum rock size in the gradation and shall be specified on the plans and/or Special Provisions.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 127, Test Method for Material Finer Than 75  $\mu\text{m}$  Sieve in Mineral Aggregate by Washing
- ASTM C 131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Armour Rock shall be hard, durable, field or quarry stone, free from splits, seams or defects likely to impair its soundness during handling or by the actions of water and ice. Shale, slate or rocks with thin foliations shall not be acceptable. The greatest dimension of each rock shall not exceed two times the least dimension. The minimum density of the rock shall be 2 650  $\text{kg/m}^3$ . Physical properties shall be as defined in Table 3.8.1. Sizes of Armour rock shall be as defined in Table 3.8.2.

Table 3.8.1 - Physical Properties

| Property                        | Test Method | Armour Rock |
|---------------------------------|-------------|-------------|
| Absorption, % maximum           | ASTM C 127  | 1.5         |
| Los Angeles Abrasion, % maximum | ASTM C 131  | 35          |

Table 3.8.2 - Armour Rock Sizes

| Approximate Maximum Dimension, mm | Percent Smaller Than |        |
|-----------------------------------|----------------------|--------|
|                                   | R1                   | R2     |
| 1 050                             | 100                  |        |
| 850                               |                      | 100    |
| 650                               | 0 - 50               |        |
| 550                               |                      | 0 - 50 |
| 300                               | 0 - 15               |        |
| 230                               |                      | 0 - 15 |

## 5.0 CONSTRUCTION METHODS

The Armour Rock shall be placed to the lines and grades shown on the drawings or as directed by the Engineer. Placement shall be by machine in order to avoid waste and to ensure that the stone is in a stable position.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

The rock shall be measured in cubic metres in place, unless it is not practical to so measure it, in which case it may be measured in vehicles.

## 8.0 BASIS OF PAYMENT

Armour Rock will be paid at the contract unit price bid per cubic metre of Armour Rock. The price shall be full compensation for furnishing all materials, equipment, and labour required to carry out the excavating, handling, hauling, placing and compacting of the Armour Rock.

## 9.0 WARRANTY





**Division 3 Granular Materials****Section 9 Rock Fill****SECTION 9 - ROCK FILL****1.0 DESCRIPTION**

The Contractor shall furnish Rock Fill in cribs or where required, as directed by the Engineer.

**2.0 REFERENCES****3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

The stone may be field or quarry stone and of such sizes as may be approved. All pieces of stone shall be sound and subject to approval.

**5.0 CONSTRUCTION METHODS****6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHODS OF MEASUREMENT**

The quantity to be paid for shall be the number of cubic metres actually placed as directed and to the satisfaction of the Engineer. Measurements shall be made in vehicles before being placed.

**8.0 BASIS OF PAYMENT**

The volume measured as provided above, of work completed and accepted, will be paid for at the contract unit price bid per cubic metre for Rock Fill, which price shall be full compensation for all work prescribed under this section, including all materials, equipment, labour and incidentals necessary to complete the work in a satisfactory manner.

**9.0 WARRANTY**



## Division 3 Granular Materials

## Section 10 - Fill Against Structure

## SECTION 10 - FILL AGAINST STRUCTURE

## 1.0 DESCRIPTION

Fill Against Structure (FAS) shall consist of the supply, placing and compaction of material, as hereinafter specified, adjacent to structures.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 117, Test Method for Material Finer Than 75  $\mu\text{m}$  Sieve in Mineral Aggregate by Washing
- ASTM C 131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C 136, Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- Division 1 Section 4, General Provisions
- Division 2 Section 8, Compaction
- Division 3 Section 5, Compaction of Gravels

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Fill Against Concrete Structures.** The material for Fill Against Concrete Structures shall be crushed and screened gravel or rock. It shall be approved by the Engineer prior to utilization.

**4.2 Gradation Requirements.** Fill Against Concrete Structures shall be tested in accordance with ASTM C 117 and C 136 and shall conform to the requirements as detailed in Table 3.10.1.

Table 3.10.1 - Gradation

| Sieve Size $\mu\text{m}$ | Percent Passing |
|--------------------------|-----------------|
| 112 000                  | 100             |
| 40 000                   | 60 - 85         |
| 5 000                    | 25 - 50         |
| 315                      | 5 - 15          |
| 80                       | 2 - 7           |

**4.3 Fill Against Metal Structures.** The material for Fill Against Metal Structures shall be crushed and screened gravel or rock. It shall be approved by the Engineer prior to utilization.

**4.4 Gradation Requirements.** Fill Against Metal Structures shall be tested in accordance with ASTM C 117 and C 136 and shall conform to Gravel Type 2 requirements as detailed in Table 3.10.2.

Table 3.10.2 - Gradation

| Sieve Size, $\mu\text{m}$ | Percent Passing      |
|---------------------------|----------------------|
| 80 000                    | 100                  |
| 56 000                    | 70 - 100             |
| 28 000                    | 50 - 80              |
| 14 000                    | 35 - 65              |
| 5 000                     | 20 - 50              |
| 160                       | 5 - 12               |
| 80                        | 3 - 5 <sup>(1)</sup> |

<sup>(1)</sup> Where percentages passing the 5000  $\mu\text{m}$  sieve are between 20 and 35%, the allowable percentage passing the 80  $\mu\text{m}$  sieve shall be 3 to 8%.

**4.5 Physical Properties.** Fill Against Structure shall conform to the requirements as listed in Table 3.10.3.

Table 3.10.3 - Physical Properties

| Property                        | Test Method | FAS      |
|---------------------------------|-------------|----------|
| LA Abrasion (Grading A)         | ASTM C 131  | 45       |
| Plasticity Index <sup>(1)</sup> | ASTM D 4318 | $\leq 6$ |

<sup>(1)</sup> Sand portion

**Division 3 Granular Materials****Section 10 - Fill Against Structure****5.0 CONSTRUCTION METHODS**

The material shall be placed in layers not exceeding 300 mm in thickness and each layer shall be compacted by means of a vibratory compactor.

The embankment underlying the Fill Against Structure shall be compacted as detailed in Division 2 Section 8 except the control strip shall be considered as the areas under the Fill Against Structure. The FAS shall be compacted as detailed in Division 3 Section 5 except the control strip shall be considered as each lift of Fill Against Structure. Special equipment, suitable for compaction in confined spaces, shall be employed on material adjacent to the structure.

The extent of Fill Against Structure on any approach shall be as indicated on the plans or as determined by the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The Contractor shall, at their own expense, provide, install and maintain such approved scales and all suitable facilities as detailed in Division 1 Section 4 Subsection 39.

**8.0 BASIS OF PAYMENT**

Fill Against Structure will be paid for at the contract unit price per tonne for Fill Against Concrete Structures or Fill Against Metal Structures, complete in place, which price shall be full compensation for furnishing all materials, including water if and when required for compaction and shall cover the supplying of all equipment, plant, labour, and incidentals necessary to complete the work.

**9.0 WARRANTY**

## Division 3 Granular Materials

## Section 11 Unshrinkable Backfill

## SECTION 11 - UNSHRINKABLE BACKFILL

## 1.0 DESCRIPTION

Unshrinkable backfill, also known as controlled low density material, is used for backfill in underground service, utility trenches, and structures.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 5 Section 7, Cast in Place Concrete Reference Standards
- CSA A23.1, Concrete Materials and Methods of Concrete Construction
- CSA A23.2, Methods of Test for Concrete

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The submission and design requirements shall be in accordance with Division 5 Section 7 except as noted herein and shall include at least three sets of 28 day compressive strength results to demonstrate the strength characteristics for the materials proposed for the mixture design. Testing the coarse aggregates for contribution to alkali aggregate reactivity (AAR) is not required.

## 4.0 MATERIALS

The materials used to produce unshrinkable backfill, portland cement, ie. fly ash, water, aggregates and admixtures, shall meet the applicable requirements of Division 5 Section 7.

Aggregate gradations other than those specified in Division 5 Section 7 may be authorized by the Engineer, however, these gradations shall be submitted as part of a mixture design submitted as per Subsection 3.0 of this specification. The maximum percentage passing the 80  $\mu$ m sieve shall not exceed 9%.

The mixture shall be proportioned to provide the following properties:

- The portland cement content shall be 25 kg/m<sup>3</sup>.
- The slump at point of discharge shall be minimum 150 mm
- The specified compressive strength at 28 days shall be maximum 1.0 MPa
- The use of fly ash, in addition to the noted portland cement content, may be used in such proportion so as not to exceed the specified compressive strength.
- Coarse aggregates, if used in the mixture, are exempt from evaluation for contribution to alkali aggregate reactivity (AAR).

## 5.0 CONSTRUCTION METHODS

**5.1 Material Placement Requirements.** The material shall be capable of flowing into the excavation so that it fills the entire space without voids being created beneath horizontal projections or in other locations within the excavation.

When shoring, bracing or sheeting is to be removed it shall be removed prior to or during the backfilling operation.

The unshrinkable backfill shall be completely placed within 120 minutes from the time of batching.

**5.2 Equipment.** The unshrinkable backfill shall be produced in a ready mixed concrete plant or central batch plant meeting the requirements of Division 5 Section 7.

The unshrinkable backfill shall be transported to the site by means of ready mix trucks.

**5.3 Protection.** The Contractor shall provide adequate measures to protect the newly placed unshrinkable backfill from damage by vehicular or pedestrian traffic by covering with steel plates of sufficient strength to support traffic. The plates shall be placed beyond the extent of any horizontal voids beneath the existing pavement surface and remain in place.

Where vehicular traffic is not accommodated, the unshrinkable backfill shall be suitably protected with planking or barrier fences until the fill can support the mass of an adult person.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Quality Control.** The Contractor shall be responsible for the mixture proportions as described above and according to Division 5 Section 7.

**6.2 Quality Assurance.** Compressive strength tests will be conducted by the Department or its representative in accordance with the following requirements:

- Only 150 mm diameter by 300 mm wax cardboard molds shall be used to cast the test cylinders. A disc of wax paper matching the inside diameter of the cylinder mold shall be placed at the base of the cylinder mold prior to casting. The interior of the mold shall be lightly coated with a form release agent to assist in demolding.
- The cylinders shall be demolded on the same day of testing for compressive strength. The cylinders shall be tested at 28 days.



**Division 3 Granular Materials**

**Section 11 Unshrinkable Backfill**

- The load indicating device of the compression machine shall be capable of incremental load increments of 100 N (0.1kN) or less.
- The minimum test requirement shall be one set of two test cylinders per day of placement.

**7.0 METHOD OF MEASUREMENT**

Unshrinkable backfill shall be measured by the number of cubic metres placed and based on delivery slip quantity with adjustment for any portion wasted or not used.

**8.0 METHOD OF PAYMENT**

No additional payment will be made for Unshrinkable Backfill when used to complete an item of work for which payment includes the backfilling.

Where an item for Unshrinkable Backfill is included as a tender bid item, payment will be made per cubic metre at the unit price in the Contract, which price shall be full compensation for all labour, equipment and materials required to complete the work.

**9.0 WARRANTY**

## Division 4 Pavements

## Section 1 Emulsified Asphalt

## SECTION 1 - EMULSIFIED ASPHALT

## 1.0 DESCRIPTION

The Contractor shall, where directed, supply, transport and apply emulsified asphalt upon the existing asphalt concrete base or a prepared or primed surface prior to the application of asphalt concrete or graded aggregate. The Contractor shall also, where directed, supply, transport and add emulsified asphalt to Recycled Asphalt Concrete to rejuvenate the mix.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 140, Practice for Sampling Bituminous Materials
- ASTM D 244, Test Methods for Emulsified Asphalts
- Seal Coat and Surface Treatment Construction and Design Using Asphalt Emulsions, Dr N MacLeod
- Recommended Performance Guidelines, AEMA

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Source of Supply.** The Contractor shall only purchase emulsified asphalt from suppliers whose emulsion plants have been approved by the Department.

**3.2 Notice of Supply.** Bidders shall nominate their source of emulsified asphalt as a supplement to the tender. On the form "Statement of Asphalt Cement, Liquid Asphalt-Primer and Emulsified Asphalt-Tack" Bidders shall be required to submit with their tender a statement as to the source (emulsion plant) of emulsified asphalt. The Bidder shall only nominate one source of supply of emulsified asphalt.

No tender will be considered that does not include the above information.

The Contractor is hereby advised that if the source (emulsion plant) they nominate has not been approved by the Department, then it shall be a requirement that the emulsion plant receive approval before any emulsified asphalt can be used on a Department project. In the event that the Contractor wishes to change their source of supply during the progress of the contract, the change shall be approved in writing by the District Director before the alternate source can be used.

## 4.0 MATERIALS

**4.1 Emulsified Asphalts.** These products shall conform to the specifications for RS-1, HF-150S, CRS-2 and SS-1 as detailed in Table 4.1.1.

## 5.0 CONSTRUCTION METHODS

**5.1 General.** When applying emulsions, the Contractor shall cover concrete walks, curbs, walls and adjacent surfaces along the highway with paper or other satisfactory covering and shall remove all emulsified asphalt which adheres to the concrete. No additional compensation will be allowed the Contractor for this work. Any accidental spills or any material that runs off the road surface shall be cleaned up immediately.

Emulsified asphalt shall only be applied to dry surfaces.

**5.2 Application of Tack Coat.** The Contractor shall clean surfaces to be tacked by means of a rotary power broom or hand brooms to remove all dirt, sand, dust or other objectionable matter. The Contractor shall apply a uniform cover of the RS-1 emulsion with a distributor at a rate of 140 ml/m<sup>2</sup>, or as directed by the Engineer, and at a temperature not less than 20°C nor more than 70°C. Hot mix shall not be placed upon the tack coated areas until the tack coat has dried to a condition of tackiness. No more tack coat shall be applied than can be covered with asphalt concrete wearing surface in any one day.

**5.3 Application of Emulsion for Graded Aggregate Seal (Two Courses) over Gravel/Sand Seal.** The Contractor shall sweep or compact the primed gravel surface or sweep the sand seal surface as deemed necessary by the Engineer. Sweeping shall be done by means of a rotary power broom to remove all dirt, sand, dust or other objectionable matter. The Contractor shall apply a uniform cover of the HF-150S emulsion with a distributor at a temperature between 60°C and 80°C and at a design rate in the range of 1.5 - 2.0 L/m<sup>2</sup>. During the application of the emulsified asphalt, the distributor shall not exceed a forward speed of 100 m/min.

After brooming the initial course, the Contractor shall apply a uniform cover of the emulsified asphalt with a distributor at a temperature between 60°C and 80°C and at a design rate in the range of 1.5 - 1.9 L/m<sup>2</sup>.

## Division 4 Pavements

## Section 1 Emulsified Asphalt

Table 4.1.1 Physical Requirements of Emulsified Asphalt

| Requirements                           | Rapid Setting Emulsified Asphalt: RS-1 |     | High-Float Emulsified Asphalt: HF-150S |      | Rapid Setting Cationic Emulsified Asphalt: CRS-2 (RS-2K) |     | Slow Setting Emulsified Asphalt: SS-1 |     |
|----------------------------------------|----------------------------------------|-----|----------------------------------------|------|----------------------------------------------------------|-----|---------------------------------------|-----|
|                                        | Min                                    | Max | Min                                    | Max  | Min                                                      | Max | Min                                   | Max |
| Saybolt Viscosity <sup>(1)</sup> , S   | 20                                     | 100 |                                        |      |                                                          |     | 20                                    | 60  |
| Saybolt Viscosity <sup>(2)</sup> , S   |                                        |     | 35                                     | 150  | 150                                                      | 400 |                                       |     |
| Residue <sup>(3)</sup> , %             | 55                                     | --  | 62                                     | --   | 68                                                       | --  | 55                                    | --  |
| Storage Stability <sup>(4)</sup> , %   | --                                     | 1.5 | --                                     | 1.5  | --                                                       | 1   | --                                    | 1.5 |
| Sieve Test <sup>(5)</sup> , %          | --                                     | 0.1 | --                                     | 0.1  | --                                                       | 0.1 | --                                    | 0.1 |
| Demulsibility <sup>(6)</sup> , %       | 60                                     | --  |                                        |      |                                                          |     |                                       |     |
| Demulsibility <sup>(7)</sup> , %       |                                        |     | 75                                     | --   |                                                          |     |                                       |     |
| Particle Charge <sup>(8)</sup>         | Negative                               |     | Negative                               |      | Positive                                                 |     | Negative                              |     |
| Oil Portion <sup>(9)</sup>             |                                        |     | 0.5                                    | 4    | --                                                       | 3   |                                       |     |
| Penetration <sup>(10)</sup> , 0.1 mm   |                                        |     | 150                                    | 250  |                                                          |     | 100                                   | 200 |
| App Viscosity <sup>(11)</sup> , Pa.s   |                                        |     | 90                                     | 3000 |                                                          |     |                                       |     |
| Float Test <sup>(12)</sup> , S         |                                        |     | 1200                                   | --   |                                                          |     |                                       |     |
| Solubility <sup>(13)</sup> , %         |                                        |     | 97.5                                   | --   |                                                          |     | 97.5                                  | --  |
| Settlement in 5d <sup>(14)</sup> , %   |                                        |     |                                        |      | --                                                       | 5   |                                       |     |
| Ductility <sup>(15)</sup> , cm         |                                        |     |                                        |      |                                                          |     | 60                                    | --  |
| Cement Mixing Test <sup>(16)</sup> , % |                                        |     |                                        |      |                                                          |     | --                                    | 2.0 |
| Tests on Residue                       |                                        |     |                                        |      |                                                          |     |                                       |     |
| Penetration <sup>(17)</sup> , 0.1 mm   | 100                                    | 200 |                                        |      | 100                                                      | 250 |                                       |     |
| Ductility <sup>(15)</sup> , cm         | 60                                     | --  |                                        |      | 60                                                       | --  |                                       |     |
| Solubility <sup>(13)</sup> , %         | 97.5                                   | --  |                                        |      | 97.5                                                     | --  |                                       |     |

<sup>(1)</sup> ASTM D 244, tested at 25°C using a Furol orifice.<sup>(2)</sup> ASTM D 244, tested at 50°C using a Furol orifice.<sup>(3)</sup> ASTM D 244, residue from distillation and expressed as % by mass.<sup>(4)</sup> ASTM D 244, tested in 24 hrs and expressed as % by mass.<sup>(5)</sup> ASTM D 244, % by mass retained on a 1000 sieve.<sup>(6)</sup> ASTM D 244, using 35 ml of 1.11 g/L CaCl<sub>2</sub> and expressed as % by mass.<sup>(7)</sup> ASTM D 244, using 50 ml of 5.55 g/L CaCl<sub>2</sub> and expressed as % by mass.<sup>(8)</sup> ASTM D 244, tested using 12V direct current and

expressed as negative (anionic) or positive (cationic) charge.

<sup>(9)</sup> ASTM D 244, oil portion of residue from distillation and expressed as % by mass.<sup>(10)</sup> ASTM D 244 and D 5 at 25°C, 100 g and 5s.<sup>(11)</sup> ASTM D 244 and D 2171, tested at 60°C.<sup>(12)</sup> ASTM D 244 and D 139, tested at 60°C.<sup>(13)</sup> ASTM D 244 and D 2042 using trichloroethylene and expressed as % by mass.<sup>(14)</sup> ASTM D 244, % by mass. The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 d time.

## Division 4 Pavements

## Section 1 Emulsified Asphalt

(15) ASTM D 244 and D 113 at 25°C and 5 cm/min.

(16) ASTM D 244 expressed as % by mass.

(17) ASTM D 244 and D 5 at 25°C, 100 g and 5s.

**5.4 Application of Emulsion for Graded Aggregate Seal (One Course) over Reclaimed Asphalt Concrete/Sand Seal/Chip Seal.** The Contractor shall sweep the reclaimed asphalt concrete, sand seal or chip seal surface by means of a rotary power broom to remove all dirt, sand, dust or other objectionable matter deemed necessary by the Engineer. The Contractor shall apply a uniform cover of the HF-150S emulsion with a distributor at a temperature between 60°C and 80°C and at a design rate in the range of 1.5 - 2.0 L/m<sup>2</sup>. During the application of the emulsified asphalt, the distributor shall not exceed a forward speed of 100 m/min.

**5.5 Application of Emulsion for Seal Coat over Asphalt Concrete.** The Contractor shall sweep the asphalt concrete surface by means of a rotary power broom to remove all dirt, sand, dust or other objectionable matter, when deemed necessary by the Engineer. The Contractor shall then uniformly apply the CRS-2 emulsion with a distributor at a temperature between 60°C and 80°C and at a design rate in the range of 1.5 - 2.0 L/m<sup>2</sup>.

The Contractor shall determine the rate of application of the emulsified asphalt, taking into consideration such variables as the texture and absorbency of the surface, traffic density and other pertinent factors, as outlined in "Seal Coat and Surface Treatment Construction and Design Using Asphalt Emulsions", by Dr. Norman McLeod and "Recommended Performance Guidelines", by the Asphalt Emulsion Manufacturers Association.

**5.6 Application of Emulsified Asphalt for Reclaimed Asphalt Paving.** The Contractor shall add a precisely metered amount of emulsified asphalt to the RAC material using a Midland Paver, or an approved equivalent. Approximately 4.5 L/m<sup>2</sup> of SS-1 emulsion per 90 mm of RAC thickness is required, however, field adjustments in the application rate may have to be made by the Contractor depending on the gradation of the reclaimed material.

**5.7 Pressure Distributor.** The pressure distributor referred to in Subsections 5.1 to 5.4 shall be a self-powered pressure asphalt distributor, capable of applying the emulsified asphalt uniformly, at the established rate, in one application, over the full required width. It shall consist of a fully insulated tank, permanently and rigidly mounted on a truck or trailer, capable of accurately maintaining any speed required for spraying.

The distributor shall be provided with the following minimum equipment:

- Proper hand spray attachments to uniformly apply emulsion to any areas missed by the distributor.
- An efficient and positive means of heating the emulsified asphalt uniformly to any selected temperature up to 100°C, and maintaining the contents constantly at this temperature without any local overheating and including a satisfactory method of circulating the contents during the entire heating process.
- An approved thermometer with a minimum range of 10°C to 100°C, graduated in intervals of not more than 10°C, so placed as to accurately show the temperature of the distributor contents, and to be accessible to the Engineer.  
An approved tachometer, driven from a fifth wheel, mounted so that it is readily visible to the driver so that it clearly and accurately registers distances traveled when spraying emulsion, and so that it enables the driver to maintain a constant speed required to ensure the specified rate of application of the emulsion.
- A pump tachometer which registers pump output within 3%.
- A pressure gauge indicating the pressure in the spray bar within 15 kPa.
- A rear mounted spray bar set parallel to the surface to be sprayed, and capable of adjustment to provide any required spraying widths from 2.5 m to 3.5 m. The distributor shall be equipped with a spray bar heating and circulating device, to ensure uniform viscosity and pressure of the emulsified asphalt at each nozzle, both before and during spraying operations. The spray bar shall be provided with a positive shut-off to prevent dripping.

The circulating system shall also be provided with a strainer to prevent clogging of the bar and nozzles. The spray bar height shall be adjustable and shall be set at such a height that the spray fan from any nozzle overlaps the spray fan from the adjacent nozzle by two-thirds for triple-lap so that a uniformly sprayed surface will result. This height shall be set when the distributor is one-half full, and shall be changed only when permitted by the Engineer.

Spray bar nozzles shall be designed and set so as to ensure uniform fan shaped sprays. The nozzles shall not be set so as to produce such a fine mist that the emulsified asphalt will blow away and not provide an even spread. All spray nozzles shall be of the same manufacture, size, type and in good condition and shall be provided with valves capable of instant full opening and positive cut-off. All spray nozzles shall be set in the bar so that the nozzle slots make the same horizontal angle (30°) with the longitudinal axis of the bar. Before work commences, and periodically as required during spraying operations, the nozzles on the spray bar shall be removed, cleaned sufficiently to

**Division 4 Pavements****Section 1 Emulsified Asphalt**

remove all congealed asphalt and to free the nozzle opening. Each nozzle shall be inspected and approved by the Engineer and reinstalled on the spray bar at the correct angle.

A strainer shall be provided in the filling line to prevent entry of foreign material into the tank.

A sampling cock shall be fitted on the spray bar or circulating line, and shall be readily accessible to allow samples of the emulsion to be obtained directly from the distributor.

The distributor shall be checked for calibration by the Engineer before being used on the work.

An alternate means of application may be permitted for small or isolated areas at the discretion and approval of the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

The emulsified asphalt from each tanker shall be sampled in accordance with ASTM D 140 by the Department or its representatives and shall conform to the requirements as follows except when a modified emulsified asphalt is required it shall conform to the Special Provisions.

Any contamination of the emulsified asphalt and/or deviation from this specification shall be corrected to the satisfaction of the Engineer and at no cost to the Department.

Such deficiencies may be noted from samples of emulsified asphalt taken by representatives of the Department. Any necessary remedial measures shall be done by the Contractor at no expense to the Department and to the satisfaction of the Engineer.

**6.1 Notification of Deliveries.** To ensure that the Department has someone available to carry out sampling the Contractor shall notify the Engineer of the approximate time of delivery of all loads. For loads that are to be delivered after 5:00 p.m. on normal work days, the Contractor shall give the Engineer notification prior to 4:00 p.m. on the day of the delivery. Notification of weekend deliveries shall be given to the Engineer before 4:00 p.m. on Friday.

**7.0 METHOD OF MEASUREMENT**

The volume of emulsified asphalt shall be calculated at a temperature of 15°C.

**8.0 BASIS OF PAYMENT**

The emulsified asphalt will be paid for at the contract unit price per litre or kilolitre in place, which price shall be full compensation for supplying, cleaning the surface before application, heating, handling, transporting, and applying of this material and the furnishing of all equipment, and labour incidental to the work.

**9.0 WARRANTY**



## Division 4 Pavements

## Section 2 Asphalt Cement

## SECTION 2 - ASPHALT CEMENT

## 1.0 DESCRIPTION

This item shall include the supply and transportation of all Asphalt Cement to the Contractor's plant that is used in the manufacture of asphalt concrete and is accepted in place.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 5, Test Method for Penetration of Bituminous Materials
- ASTM D 92, Test Method for Flash and Fire Points by Cleveland Open Cup
- ASTM D 140, Practice for Sampling Bituminous Materials
- ASTM D 1754, Test Method for Effect of Heat and Air on Asphaltic Materials
- ASTM D 2042, Test Method for Solubility of Asphalt Materials in Trichloroethylene
- ASTM D 2170, Test Method for Kinematic Viscosity of Asphalts

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Notice of Supply.** Bidders shall nominate their source of asphalt cement and provide a Statement of Supplier's price for asphalt cement as a supplement to the tender. On the form "Statement of Asphalt Cement, Liquid Asphalt-Primer and Emulsified Asphalt-Tack", Bidders shall:

- Submit with their tender a statement as to the source of asphalt cement. The Bidder shall only nominate one source of supply of asphalt cement.
- Indicate the Supplier's Posted Rack Price for asphalt cement FOB refinery (excluding taxes). For confirmation, the Bidder shall attach the written price quotation from the Supplier, which price shall be effective at time of award of contract and shall remain in effect until the end of the current calendar year.

No tender shall be considered that does not include the above information.

**3.2 Contracts Completed in Calendar Year.** In the event that the Contractor wishes to change the source of supply during the progress of the contract, the Contractor shall apply for approval, in writing, to the District Director. Approval in writing must be given by the District Director before the source of supply is changed.

The Contractor shall not be compensated for any increase in the cost of asphalt cement in the calendar year in which the asphalt work was initially intended to be done.

**3.3 Contracts Carried Over To The Next Calendar Year.** In the event the Supplier's Posted Rack Price increases or decreases subsequent to the end of the calendar year in which the asphalt work was initially scheduled and one of the following conditions is satisfied, then a price increase or decrease will be considered:

- In the opinion of the Department, a delay caused by another Contractor working on the contract site adversely affects the start-up date of the Contract resulting in the completion of paving being delayed until the following year; or
- In the opinion of the Department, the lateness in tender call makes it unreasonable for the Contractor to finish asphalt work that year. This will be noted in the Special Provisions of the contract; or
- In the opinion of the Department, for reason(s) beyond the control of the Contractor, the work could not be completed before the end of the calendar year in which the work was initially intended to be completed.

If the request for a price increase or decrease is approved by the District Director the Contractor will be assessed an increase or decrease for an amount equal to the actual dollar difference between the Supplier's original Posted Rack Price quotation and the Supplier's new Posted Rack Price for asphalt cement. In all cases the Supplier's Posted Rack Price quotation for the price of asphalt cement for the next calendar year shall be submitted to the Engineer before the Contractor will be paid for any asphalt cement used that year. Any claim for a price difference by the Contractor shall be supported by the Supplier's invoice.

## 4.0 MATERIALS

**4.1 Source of Supply.** The asphalt cement to be supplied for Department contracts shall be stored in heated storage tank(s). The total minimum storage capacity shall be 4000 t per product supplied. The Department reserves the right to take samples from the Supplier's storage tank(s).

**4.2 Asphalt Cement.** The asphalt cement shall be homogeneous, free of water and any contamination and shall not foam when heated to 175°C and shall conform to the requirements specified in Table 4.2.1.



## Division 4 Pavements

## Section 2 Asphalt Cement

Table 4.2.1 - Physical Requirements of Asphalt Cement  
Penetration Grade <sup>(1)</sup>

| Property                                      | 80/100 |      | 150/200 |     | 200/300 |     |
|-----------------------------------------------|--------|------|---------|-----|---------|-----|
|                                               | MIN    | MAX  | MIN     | MAX | MIN     | MAX |
| Penetration <sup>(2)</sup> , 0.1 mm           | 80     | 100  | 150     | 200 | 200     | 300 |
| Viscosity <sup>(3)</sup> , mm <sup>2</sup> /s | 290    | --   | 185     | --  | 145     | --  |
| Flash Point <sup>(4)</sup> , °C               | 230    | --   | 220     | --  | 175     | --  |
| Loss in Mass <sup>(5)</sup> , %               | --     | 0.85 | --      | 1.3 | --      | 1.5 |
| Penetration <sup>(6)</sup> , Loss, %          | 47     | --   | 40      | --  | 37      | --  |
| Solubility <sup>(7)</sup> , %                 | 99     | --   | 99      | --  | 99      | --  |
| Temperatures <sup>(8)</sup> , °C              |        |      |         |     |         |     |
| Spraying                                      | 160    | 175  | 145     | 160 | 145     | 160 |
| Mixing                                        | 135    | 160  | 120     | 145 | 120     | 145 |
| Pumping                                       | 125    | 175  | 115     | 160 | 115     | 160 |

(1) When modified asphalt cement is required, it shall conform to the Special Provision requirements.

(2) ASTM D 5 tested at 25°C with 100 g in 5s.

(3) ASTM D 2170 tested at 135°C.

(4) ASTM D 92 with the Cleveland Open Cup.

(5) ASTM D 1754, the Thin Film Oven Test.

(6) ASTM D 1754 on the residue from the Thin Film Oven Test at 25°C with 100 g in 5s, in 0.1 mm units and expressed as a % of the original penetration.

(7) ASTM D 2042, in trichloroethylene as a % by mass.

(8) Working temperature to provide kinematic viscosities of 150 mm<sup>2</sup>/s, 300 mm<sup>2</sup>/s, and 600 mm<sup>2</sup>/s for spraying, mixing and pumping respectively.

## 5.0 CONSTRUCTION METHODS

**5.1 Tankers, Storage Tanks.** Tankers used to transport asphalt cement and asphalt cement storage tanks located at asphalt concrete mixing plants shall meet the following requirements:

- Be free from hydrocarbon fuels or solvents, such as gas, diesel, varsol, gasoline, etc.
- Have a sampling spigot as outlined in ASTM D140.
- Be equipped with thermometers, accurate and capable of reading to the nearest 2°C.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Notification of Deliveries.** To ensure that the Department may have someone available to carry out sampling when desired (in accordance with ASTM D 140), it shall be a requirement that the Contractor notify the Engineer of the approximate time of delivery of all

loads. For loads that are to be delivered after the plant operation hours on normal work days, the Contractor shall give the Engineer notification prior to 4:00 p.m. on the day of delivery. Notification of weekend deliveries shall be given to the Engineer before 4:00 p.m. on Friday.

**6.2 Deficiencies.** Any contamination or nonconformance of the product to the requirements as specified in Table 4.2.1 of this specification shall be corrected to the satisfaction of the Engineer at no cost to the Department.

## 7.0 METHOD OF MEASUREMENT

The quantity of asphalt cement to be paid for under this section shall be calculated on the basis of the asphalt cement delivered to the plant. The Department will not reimburse the Contractor for asphalt cement that is used in private work or any that is wasted as calculated

**Division 4 Pavements****Section 2 Asphalt Cement**

on the weekly asphalt report. Adjustments will be made for initial and final tank measurements corrected to 15°C.

Plants that produce a large percentage of asphalt concrete for private work, such as in the Halifax-Dartmouth area and the Sydney area, will be paid for supply and transportation as calculated by the Field Adjusted Mix Design. The tonnages thus calculated will be payable to the Contractor.

**8.0 BASIS OF PAYMENT**

The supply and transportation of asphalt cement will be paid for at the contract unit price per tonne of asphalt cement. This price shall be compensation for any and all expenses that may be incurred in the supply, transport and delivery of the asphalt cement to the Contractor's plant.

**9.0 WARRANTY**



## Division 4 Pavements

## Section 3 Asphalt Concrete Curbs &amp; Gutters

**SECTION 3 - ASPHALT CONCRETE CURBS & GUTTERS****1.0 DESCRIPTION**

Asphalt concrete for curbs, gutters and drains shall consist of carefully controlled hot-laid plant mix of asphalt cement and dense graded quality aggregate thoroughly mixed and then compacted to a uniform density. It shall be placed on a prepared base in conformity with the lines, grades and cross-sections as shown in the plans herein and as directed by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 3 Section 5, Compaction of Gravels
- Division 4 Section 1, Emulsified Asphalt
- Division 4 Section 2, Asphalt Cement
- Division 4 Section 4, Asphalt Concrete-Hot Mixed-Hot Placed
- Drawing HS402.DWG.
- Drawing HS403.DWG.

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

At the discretion of the Engineer an asphalt concrete mix design for Type B or Type C may be provided as detailed in Division 4 Section 4 or an existing plant mix may be used.

**4.0 MATERIALS**

**4.1 Aggregate.** The aggregate shall conform to the specifications detailed in Division 4 Section 4 for asphalt concrete Type E. When gutter mix is placed using an asphalt road spreader or spreader attachment in conjunction with the road paving operation, the Engineer may approve the use of Type B or Type C asphalt concrete.

**4.2 Asphalt Cement.** Unless otherwise specified, the asphalt cement shall be 150/200 penetration grade. The asphalt concrete shall contain 6.0 to 9.0% asphalt cement by mass of total mix. When gutter mix is placed in conjunction with road paving using the road spreader or spreader attachment the asphalt cement type and amount will be as specified for the Type B or Type C mix.

**4.3 Asphalt Concrete.** The production, transportation and placement of the asphalt concrete shall conform to

the requirements of Division 4 Section 4.

**5.0 CONSTRUCTION METHODS**

**5.1 Curb.** The contractor shall construct curb according to Drawing HS402 in specified locations. The machine used for placing the curb shall be self-powered and capable of extruding and compacting the asphalt concrete to the line, grade and cross-section shown on the plans or otherwise specified.

The surface on which the curb is to be placed shall be dry and free from all loose and foreign material. A tack coat shall be applied to the surface at a rate of 500 to 800 ml/m<sup>2</sup>. For proper support on the pavement edge, the back of the curb should be a minimum of 150 mm from the edge unless otherwise specified by the Engineer.

**5.2 Gutter.** The Contractor shall construct asphalt concrete gutter as and where directed according to the Department plan for Asphalt Concrete Gutter, Drawing HS403 or to such other dimensions approved by the Engineer.

Where the gutter is to be placed on a granular base the base material shall be graded to the shape of the gutter and then compacted as detailed in Division 3 Section 5 except that the size of the control strip may be modified at the direction of the Engineer.

In areas where the gutter is to be placed subsequent to road surface paving, tack coat conforming to the requirements of Division 4 Section 1 of these specifications shall be applied to the edge of the previously placed asphalt concrete pavement at a rate of 500 to 800 ml/m<sup>2</sup> before the asphalt concrete gutter is placed.

Upon completion of placing and shaping, the asphalt concrete for gutter shall be compacted to 94% of the theoretical maximum relative density or to the satisfaction of the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

**7.1 Curb.** The quantity of curb for which payment will be made shall be the length placed as measured along the line and grade of the curb. Modified curb sections across driveways are to be included in the measurement.

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**7.2 Gutter.** The quantity of gutter for which payment will be made shall be the length placed as measured along the line and grade of the gutter. Length of offtakes will be measured from back of longitudinal gutter to outlet and added to the length of longitudinal gutter.

**8.0 BASIS OF PAYMENT**

Payment will be made at the contract unit price per metre for Asphalt Concrete Curb or Asphalt Concrete Gutter which payment shall include the cost of

furnishing all labour, tack coat, aggregate and equipment necessary to satisfactorily complete the work.

**8.1 Supply and Transportation of Asphalt Cement.** The Contractor shall supply and transport asphalt cement to the Contractor's asphalt plant and the Department will pay supply and transportation charges as specified in Division 4 Section 2.

**9.0 WARRANTY**

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## Section 4 Asphalt Concrete Hot Mixed-Hot Placed

**SECTION 4 - ASPHALT CONCRETE HOT MIXED - HOT PLACED****1.0 DESCRIPTION**

Asphalt concrete is defined as a carefully controlled mixture of penetration grade asphalt cement and mineral aggregate thoroughly mixed to be free from segregation and contamination and then placed and compacted to a uniform density and smooth finish. This section includes requirements applicable to: quality control, materials, manufacturing, transportation, placing, compaction, finishing, measurement and payment of asphalt concrete.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 4 Section 1, Emulsified Asphalt
- Division 4 Section 2, Asphalt Cement
- Occupational Health and Safety Act
- Environmental Protection Act
- 1981 Asphalt Paving Plant Regulations
- British Standard 812, Flakiness Index
- AASHTO T 283, Resistance of Compacted Bituminous Mixture to Moisture Induced Damage
- ASTM C 88, Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
- ASTM C 117, Test Method for Material Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C 127, Test Method for Specific Gravity and Absorption of Coarse Aggregate
- ASTM C 128, Test Method for Specific Gravity and Absorption of Fine Aggregate
- ASTM C 131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C 136, Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 75, Practices for Sampling Aggregates
- ASTM D 140, Practice for Sampling Bituminous Materials
- ASTM D 546, Test Method for Sieve Analysis of Mineral Filler for Road and Paving Materials
- ASTM D 995, Specification for Requirements for Mixing Plants
- ASTM D 1559, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- ASTM D 2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
- ASTM D 2726, Test Method for Bulk Specific Gravity

of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens

- ASTM D 2950, Test Method for Density of Bituminous Concrete in Place by Nuclear Method
- ASTM D 3203, Standard Test Method for Air Voids in Compacted Bituminous Paving Mixtures
- ASTM D 3515, Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
- ASTM D 4469, Method for Calculating Percent Asphalt Absorption by the Aggregate in an Asphalt Paving Mixture
- DOT&PW TM-2, Modified Petrographic Analysis
- DOT&PW TM-3, Fractured Particle Test

The limits of placing, spread rate and the Mix Type shall be as stated in the Special Provisions.

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

**3.1 Certificate of Approval for Asphalt Plant.** The Contractor shall obtain a certificate of approval for the Asphalt Concrete Plant from the Nova Scotia Department of the Environment prior to the commencement of work.

**3.2 Mix Design.** The asphalt concrete shall conform to ASTM D 3515 except as specified herein and in the Special Provisions.

The Contractor shall have a minimum of 1000 t of coarse aggregate and 1000 t of fine aggregate placed in stockpiles before samples for mix design purposes will be taken.

The Department or its representative will obtain samples of the aggregate and any additives and undertake the mix design. In all cases, a minimum of 14 days will be required for design purposes after the samples have been taken.

An initial design will be based on the use of aggregate sources as selected by the Contractor and may require the use of blending sand from additional sources. A maximum of 15% blend sand may be used in the mix design, however, the amount of blend sand eligible for haul payment shall be the actual tonnage of blend sand used, or up to 10% by mass of the total mix in which the blend sand was required. If the blend sand design does not meet the gradation requirements of Table 4.4.4, the Contractor shall make adjustments to meet the requirements of Table 4.4.4 and Table 4.4.1. The results of each mix design will be provided to the Contractor.



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Table 4.4.1 - Physical Requirements Of Asphalt Concrete

| Item                                             | Standard                    | Requirements         | Application Road Class               | Mix Type                    |
|--------------------------------------------------|-----------------------------|----------------------|--------------------------------------|-----------------------------|
| Marshall Stability <sup>(1)</sup><br>@ 60°C, kN  | ASTM D 1559                 | MIN 7.5              | Freeway,<br>Arterial,<br>Truck Route | A,B,B-HF, C,<br>C-HF & D    |
|                                                  |                             | MIN 6.0              | Collector                            | B,C & D                     |
|                                                  |                             | MIN 4.5              | Local                                | B,C, & D                    |
| Marshall Flow, mm                                | ASTM D 1559                 | 2 - 4 <sup>(2)</sup> |                                      | A,B,B-HF, C,<br>C-HF, D & E |
| Voids in Mineral<br>Aggregate <sup>(2)</sup> , % | ASTM D 2041,<br>ASTM D 4469 | MIN 15               |                                      | C, C-HF, D & E              |
|                                                  |                             | MIN 14               |                                      | B,B-HF                      |
|                                                  |                             | MIN 13               |                                      | A                           |
| Air Voids, %                                     | ASTM D 2041                 | 3 - 5                |                                      | A,B,B-HF<br>C, C-HF, D & E  |
| VFA <sup>(4)</sup> , %                           |                             | 65 - 78              |                                      | A,B,B-HF<br>C, C-HF, D & E  |

<sup>(1)</sup> Each Marshall specimen shall receive 75 blows on each face.

<sup>(2)</sup> Bulk Specific Gravity calculated on Oven Dry basis

<sup>(3)</sup> Equivalent to 8-16 Marshall units (units of 0.25 mm each)

<sup>(4)</sup> VFA will be 70-80% for roads of <1000 AADT.

**3.2.1 Field Adjusted Mix Design.** The final laboratory mix design will be implemented as the initial trial for plant mix with any necessary adjustments immediately being made by the Department or its representative. These adjustments will be documented as the Field Adjusted Mix Design (FAMD). Any additional adjustments will result in an additional documented FAMD. Copies of all FAMD will be provided to the Contractor.

All Field Adjusted Mix Designs shall meet the requirements of Table 4.4.4, Table 4.4.1 and Subsection 3.2.2. All quality control tests will be measured against the documented FAMD.

**3.2.2 Mix Tolerance.** The maximum permissible variation from the Field Adjusted Mix Design for gradation (total aggregate) and asphalt cement content in percent by mass shall be as follows:

|                        |       |
|------------------------|-------|
| 5 000 sieve and larger | ± 5   |
| Held on 1250 sieve     | ± 3   |
| Held on 160 sieve      | ± 2   |
| Held on 80 sieve       | ± 1   |
| Asphalt Cement         | ± 0.3 |

**3.3 Additives.** Additives shall not be used in the mix without the approval of the Engineer. Any additive intended for use shall be incorporated in the mix design in the proportion to be used during production and in accordance with the Manufacturer's specifications. If silicone is being added to the asphalt cement then care shall be taken to ensure that it is being added at only one location i.e. at the refinery, in the tanker truck, or at the plant.

The Department may permit the use of antistripping agents.

All additives, except anti-stripping additives, shall be included in the unit price for Asphalt Concrete.

**3.4 Asphalt Concrete Stripping.** The Contractor is hereby advised that if their aggregate for asphalt concrete is moisture susceptible they shall have the option of either using a liquid anti-stripping additive from the Department's list of acceptable products, using hydrated lime, or changing their source of aggregate.

The Department may determine that an anti-stripping additive is required if one of the following conditions

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occurs:

- The long term tensile strength ratio of the asphalt concrete as per AASHTO T 283 is less than 0.73
- Material that has been conditioned per AASHTO T 283 meets the 0.73 minimum requirement but a visual examination indicates there is evidence of stripping
- If based on past performance the aggregate source is known to be prone to stripping

**3.4.1 Testing Rejected Aggregate Incorporating Anti-Stripping Agents.** If the aggregate for asphalt concrete fails the Stripping Test, the Contractor at their own expense for all related testing, may request through the Project Engineer that the Department's Quality Control Consultant conduct a second set of Stripping Tests, this time incorporating an anti-stripping agent. Approval to use an anti-stripping agent will only be given if it is determined from this testing that the long term TSR of the mix with an anti-stripping agent equals or exceeds 0.73 and the visual examination indicates there is no evidence of stripping. The Contractor shall also demonstrate the capability of properly adding hydrated lime to the mix at the hot-mix plant if hydrated lime is proposed for use as an anti-stripping agent. If the TSR is still less than 0.73, the aggregate will be rejected and the Contractor shall locate another aggregate source.

**3.4.2 Approval of Anti-Stripping Agents.** In all cases a minimum of 14 working days are required to perform the stripping test after the aggregates have been received by the inspection company. An additional 14 working days will be required for re-testing of aggregate with an anti-stripping agent. The Contractor shall provide the anti-stripping agents to be utilized in all testing as well as any technical information and Manufacturer's recommended addition rates.

**3.4.3 Addition of Liquid Anti-Stripping Additive.** The liquid anti-stripping additive shall be added at a rate as determined by the mix design to the asphalt cement at the Supplier's depot, concurrently, with loading of the asphalt cement into the Carriers tanker. Any other methods of adding liquid anti-stripping additive shall be subject to the approval of the Engineer. The Contractor shall be required to demonstrate the method to the Engineer before approval will be considered.

The Contractor shall supply in writing to the Department, the supplier's name, product name and percentage of liquid anti-stripping additive used for each tanker load of asphalt cement delivered to the Contract.

**3.4.4 Pavers Placing Asphalt Containing Liquid Anti-Stripping Agents.** If required, and the Contractor

elects to use a liquid anti-stripping additive, all pavers used to place asphalt concrete containing liquid anti-stripping additive shall be equipped with an engineered control ventilation system with a minimum controlled indoor capture efficiency of 80%.

**3.4.5 Weather Conditions on Projects Containing Liquid Anti-Stripping Additives.** If required, and the Contractor elects to use a liquid anti-stripping additive, the Contractor is advised that special precautions and scheduling of work may be necessary to effectively and safely produce and place asphalt concrete.

Contractors are advised that certain weather conditions such as fog, high humidity or rain require special precautions and these conditions may necessitate a shut down of operations.

If the Project Engineer determines that weather conditions are not acceptable, asphalt concrete shall not be placed. The Department takes no responsibility for costs associated with job shut downs and asphalt concrete which is not placed as a result of unacceptable weather conditions.

**3.4.6 Payment for Liquid Anti-Stripping Additives.** If required, and the Contractor elects to use a liquid anti-stripping additive, the Department will pay an amount as specified in the Contract Special Provisions for the use of an acceptable liquid anti-stripping agent which shall be full compensation for supplying, transporting and all related costs and labour incidental to the work.

If required, and the Contractor elects to use a hydrated lime as an anti-stripping additive, the Department will pay an amount as specified in the Contract Special Provisions for the use of hydrated lime which shall be full compensation for supplying, transporting and all related costs and labour incidental to the work.

#### 4.0 MATERIALS

**4.1 Aggregates.** The aggregates shall be crushed pit run or quarried stone or slag and sand conforming to the quality requirements as stated herein and shall be free from coatings of clay, silt or other deleterious material.

**4.1.1 Supply of Aggregates.** It shall be the Contractor's responsibility to locate, procure and/or manufacture and deliver all aggregates, including blend sand or blending stone, required to meet the specified combined aggregate gradation requirements or to meet other specified properties of the aggregate and of the asphalt concrete. Promptly after receiving notice of award of contract, the Contractor shall inform the Engineer of the location of all aggregate sources.

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Preliminary or previous approval of any aggregate shall not constitute a final approval of that aggregate.

**4.1.2 Blend Sand.** A definition of blend sand is as follows: Blend sand is an imported material added to a mix for the purpose of providing specified air voids and/or VMA and/or VFA. Blend sand may be either a natural uncrushed fine aggregate or a manufactured sand.

The maximum amount of natural uncrushed fine aggregate used as a blend sand shall be limited to 15% of the total aggregate in all mix types.

**4.1.3 Supply of Blend Sand.** After the Field Adjusted Mix Design has been developed (as outlined in Subsection 3.2.1) a supply of at least one day's production of blend sand shall be maintained in stockpile at all times

**4.1.4 Blending Aggregates.** Blending of aggregates from two or more sources will only be permitted when the Petrographic Number (PN) for the aggregate from any of the sources does not exceed the specified Petrographic Number by more than 10%.

The minimum amount of blended coarse aggregate shall not be less than 10% of the stone fraction. The coarse aggregate shall be blended through the cold feed bins.

Sand from another source may be used without blending, provided the stone from which the sand is produced has a PN not more than 10% higher than the specified PN. The stone portion of the mix shall have a PN less than or equal to the specified PN.

**4.1.5 Physical Requirements of Aggregates.** The physical requirements of the aggregates shall be as shown in Table 4.4.2 and Table 4.4.3.

Table 4.4.2 - Physical Requirements of Aggregate<sup>(1)</sup>

| Test Name                                                                       | Standard <sup>(2)</sup>  | Requirement     |
|---------------------------------------------------------------------------------|--------------------------|-----------------|
| Los Angeles Abrasion, %                                                         | ASTM C 131               | Max. 35         |
| Soundness, % <sup>(3)</sup>                                                     | ASTM C 88 <sup>(6)</sup> | Max. 15         |
| Fractured <sup>(4)</sup> Particles, 2 Fractured Faces, % by Mass <sup>(6)</sup> | DOT&PW <sup>(7)</sup>    | See Table 4.4.3 |
| Petrographic Number <sup>(4)</sup>                                              | DOT&PW <sup>(7)</sup>    | See Table 4.4.3 |
| Stripping Test, %                                                               | AASHTO T 283             | Min. 0.73       |
| Absorption, % <sup>(5)</sup>                                                    | ASTM C 127               | Max. 1.75       |
| Flakiness Index, %                                                              | British Standard 812     | Max. 45         |

(1) Applies to all aggregates including those used for blending.

(2) Latest edition

(3) The soundness loss permitted will be 15% on fine aggregate other than for A, B-HF, C and C-HF. Soundness loss on fines for A, B-HF, C and C-HF, will be 10%.

(4) In the event of a disagreement regarding the Petrographic Number or Fractured Particles percentage, the Contractor shall note their objections in writing to the Engineer such that the Engineer will notify the Manager of Technical Services of impending referee testing. An analysis will then be done, as follows:

- The Manager of Technical Services will arrange to have the stockpile sampled. If a Technical Services Specialist is not available to sample, the Engineer will sample the stockpile. The Contractor will observe the sampling procedure.
- The sample will be taken to Technical Services. All Consultants that are retained by the Department for asphalt concrete quality control or a minimum of two consultants, will be asked to send a representative to Technical Services to test a representative portion of the sample.
- The sample will be split and each Technician will perform the Petrographic test or Fractured Particles Test. The results will be given to Executive Director District Operations, who will make the final decision with respect to the use of the aggregate, using the average of the test results as a guide.

(5) Fine aggregate shall have maximum absorption of 2.0 % when tested by ASTM C 128.

(6) Test to be performed using sodium sulphate.

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- (7) Standard test procedures are available from Technical Services, if requested.
- (8) A fractured particle consists of two (2) fractured faces which each consist of a minimum of 20% of the surface area of the particle.

Table 4.4.3 - Quality of Coarse Aggregate vs AADT

| Type | AADT <sup>(1)</sup> | PN  | Fractured Particles, % |
|------|---------------------|-----|------------------------|
| A    | N/A                 | 135 | 95 <sup>(2)</sup>      |
| B-HF | N/A                 | 135 | 95 <sup>(2)</sup>      |
| C-HF | N/A                 | 135 | 95 <sup>(2)</sup>      |
| C    | 2500-4000           | 150 | 70                     |
| C    | 1000-2499           | 150 | 40                     |
| B    | 1000-2499           | 180 | 40                     |
| C    | Below 1000          | 180 | 40                     |
| B    | Below 1000          | 180 | 40                     |
| D    | N/A                 | N/A | N/A                    |
| E    | N/A                 | 180 | 40                     |

(1) Average Annual Daily Traffic

(2) The coarse aggregate shall be made from a quarried source or contain 95% fracture particles.

The fine aggregate shall be produced from bedrock, or in the case of a natural deposit, from the aggregate held on the 10 000 sieve. A tolerance of 10% passing the 10 000 sieve, based on a washed sieve analysis, will be permitted.

**4.1.6 Gradation of Combined Aggregate.** The gradation of the combined processed aggregate for the asphalt concrete shall conform to the values shown in Table 4.4.4 when tested by washed sieve analysis according to ASTM C 117, C 136 and D 546.

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Table 4.4.4 - Gradation of Combined Aggregates

| Sieve Designation | Cumulative Percent Passing |                  |                  |         |           |         |                              |
|-------------------|----------------------------|------------------|------------------|---------|-----------|---------|------------------------------|
|                   | Type A                     | Type B           | Type B-HF        | Type C  | Type C-HF | Type D  | Type E                       |
| 40 000            | 100                        |                  |                  |         |           |         |                              |
| 28 000            | 95-100                     | 100              | 100              |         |           |         |                              |
| 20 000            | -                          | 95-100           | 95-100           | 100     | 100       |         | 100                          |
| 14 000            | 60-80                      | -                | 70-90            | 95-100  | 95-100    | 100     | 85-100                       |
| 10 000            | -                          | 60-80            | 60-75            | -       | -         | 95-100  | -                            |
| 5 000             | 25-60                      | 35-65            | 40-55            | 45- 70  | 45-60     | 60- 80  | 65- 80                       |
| 2 500             | 15-45                      | 20-50            | 25-45            | 25- 55  | 25-55     | 35- 65  | 50- 65                       |
| 315               | 3-18                       | 3-20             | 3-20             | 5- 20   | 5-20      | 6- 25   | 18- 30                       |
| 80                | 1-7                        | 2- 8             | 3- 6.5           | 2-9     | 3-6.5     | 2-10    | 5- 15                        |
| Normal Usage      | Base                       | Base/<br>Surface | Base/<br>Surface | Surface | Surface   | Surface | Curbs/<br>Gutters<br>Medians |

**4.1.7 Stockpiling of Aggregates.** Aggregates shall be stockpiled as herein described so as to limit segregation, intermingling and contamination. Where the location of aggregate manufacture is different from the location of asphalt concrete production, stockpiles at all locations shall comply. Only those aggregates placed in stockpiles approved by the Department shall be used. Stockpiles shall be formed on evenly graded and well drained areas. Stockpiling shall not commence until the site is approved by the Engineer considering the total area required based on the maximum height allowed and the minimum quantity to be stored in the stockpiles.

The aggregate for asphalt concrete shall be separated into a coarse fraction and a fine fraction and the two fractions shall be placed in separate stockpiles.

The coarse aggregate stockpile(s) shall contain a minimum of 80% retained on the 5000 sieve by washed sieve analysis.

The fine aggregate stockpile shall contain a minimum of 80% passing the 5000 sieve by washed sieve analysis.

Stockpiles shall be built in layers not exceeding 1 m in thickness for coarse aggregate nor 2 m in thickness for

fine aggregate. Each layer shall be constructed over the entire area before the next layer is begun. The maximum height shall not exceed 4 m. Coning, end dumping or pushing aggregate over the edge of stockpiles will not be permitted. Aggregates, delivered in trucks or loaders, shall be uniformly spot dumped and the stockpile built as specified in the foregoing.

Stockpiles shall be separated either by bulkheads or distance to avoid intermingling of material in one stockpile with that in another stockpile. Placing of unacceptable aggregate on previously accepted aggregate shall be cause for rejection of the entire stockpile. Payment will not be made for any aggregate left in stockpile.

**4.1.8 Quantity of Aggregate in Stockpile During Mix Production.** The quantity of aggregate in stockpile during periods of mix production shall be the minimum of 20 hours of production for both coarse and fine aggregate or the quantity required to complete the job.

**4.2 Asphalt Cement, Supply and Inventory.** The Contractor shall supply and transport all Asphalt Cement, used in the manufacture of asphalt concrete, in accordance with Division 4 Section 2.



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The quantity of asphalt cement in the Contractor's storage tank(s) at the beginning and end of a job will be determined by the Engineer.

If there is asphalt cement in the Contractor's tank(s) at the beginning of the job that is not acceptable for use by the Department it shall be removed. If the tank is contaminated with hydrocarbon fuels or solvents, it shall be cleaned to remove all contaminants before asphalt cement to be used on the job is placed in the tank(s).

If there is asphalt cement that belongs to the Contractor in the tank(s) at the beginning of the job, and provided it meets Department's specifications, the Contractor may use it in the work.

**4.3 Anti-Stripping Agents.** The anti-stripping agents shall consist of one of the following:

- Hydrated Lime ( $\text{Ca(OH)}_2$ )
- Liquid Anti-Stripping Agent

**4.3.1 Lime**

**4.3.1.1 Lime Storage.** When hydrated lime is used as an anti-stripping agent, the Contractor shall have the capability of storing 50 t of lime at the hot-mix plant. The storage facility shall maintain the lime in dry condition and shall be capable of agitating the lime by air or other means to keep it in a uniform, free flowing condition. Storage facilities shall have the capability to accept shipments of lime while the asphalt plant is in operation.

**4.3.1.2 Metering/Feeder System-General.** The hydrated lime proportioning or metering/feeder system shall be controlled by a mass or volumetric device which shall be accurate to within  $\pm 10\%$  of the amount required. The lime metering/feeder system shall be capable of uniformly delivering lime in quantities between 0.5 to 2.5% by dry weight of aggregate. Lime shall be drawn from a storage facility as specified herein.

The lime metering/feeder system shall display the following:

- percent moisture in the total aggregate;
- tonnes per hour of dry aggregate;
- tonnes per hour of lime.

The display output shall be from actual continuous scale readings.

**4.3.1.2.1 Mass or Weight System.** This type of hydrated lime proportioning system shall consist of a continuous feeder system which shall proportion the flow rate of lime by mass or weight. The lime feeding system shall be controlled by a positive weighing

system. The system shall have the capability of continuously monitoring the flow rate of dry aggregate in tonnes per hour. The system shall automatically adjust the flow of lime for any change in dry aggregate flow rate.

**4.3.1.2.2 Volume System.** This type of lime proportioning system shall be a vane type metering device which is interlocked to the flow of each aggregate. The drive shaft on the vane feeder shall be equipped with a revolution counter and a means of varying the rate.

**4.3.1.3 Moisture Correction.** The combined moisture content of the aggregates shall be entered into the lime metering/feeder control system and the system shall be capable of providing a dry aggregate tonnes per hour signal to the lime/feeder control.

**4.3.1.4 Positive Signal System.** The lime metering/feeder system shall contain a positive signal system that automatically shuts down the plant after a 15 second delay or if there is a disruption of flow of lime or water.

**4.3.1.5 Monitoring System.** The lime metering/feeder system shall contain a means of determining the quantity of lime being introduced into the aggregate while the plant is operating.

**4.3.1.6 Calibration.** The Contractor shall check the calibration of the lime metering/feeder system prior to the production of asphalt concrete or as directed by the Engineer.

**4.3.1.7 Water Delivery System.** When dry hydrated lime is utilized, a water delivery system shall be used to dampen the combined aggregates on the cold feed belt to a moisture content between 1.5 to 3.0% above the combined saturated surface dry moisture content of the aggregates. The water delivery system shall consist of a spray bar with a minimum of 3 equally spaced spray nozzles. The spray bar shall be located so as to wet the aggregate prior to the addition of the lime.

**4.3.1.8 Water.** Potable water or water that is clean and free of dirt, silt and deleterious material shall be used as a wetting agent.

**4.3.1.9 Addition of Lime.** Lime shall be added to the aggregate by the dry method or the slurry method.

**4.3.1.9.1 Dry Method.** Hydrated lime shall be drawn from a lime storage facility by metering/feeder system and combined with aggregate and water with a mixing device as specified herein.

**4.3.1.9.2 Slurry Method.** A slurry containing one part



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hydrated lime and three parts water by mass shall be used. The slurry shall be prepared in a central mixing tank provided with agitation to keep the lime in suspension until applied to the aggregate. The plant shall be equipped with suitable pumps and meters for introducing the required amount of slurry to the aggregate. The addition of hydrated lime in the form of a slurry form shall not require adding moisture to the aggregate prior to mixing of the lime slurry and aggregate.

**4.3.1.10 Mixing Device.** Mixing of the aggregate and lime for either the dry or slurry methods shall be accomplished by passing the combined materials:

- through a scalping screen
- through a set of plows or mixing paddles on the cold feed belt
- an in-line pugmill placed in the cold feed system between the gathering conveyor and the charging conveyor

**4.3.2 Liquid Anti-Stripping Additives.** The products on the following list have been subjected to an internal review by the Department respecting formulation and the toxicology of ingredients and have been determined to meet Department criteria for use on paving projects. The acceptable liquid anti-stripping additives are as listed in Table 4.4.5.

**Table 4.4.5 - Anti-Strip Additives**

| Supplier             | Product            |
|----------------------|--------------------|
| Akzo Nobel Chemicals | Redicote 95-S      |
| Morton International | Pave Bond "T" Lite |
| Morton International | Pave Bond Lite     |
| Travis Chemicals     | Travcor 4501       |
| Win Chemicals Ltd.   | WinSurf 129-A      |
| ARR-MAZ Products     | AD-here LOF 6500   |

Inclusion on this list does not attest to efficacy of use with any specific aggregate or approval for use on any specific project. Testing for each project shall be required for this purpose. This list is subject to revision.

**4.3.2.1 Information Sessions and Worker Training.** At a pre-construction meeting the Contractor shall inform the Engineer of the supplier's name and product name of liquid anti-stripping additive that is to be used on the contract if one is required. At this time the Contractor and the Department will review the requirements for use of the liquid anti-stripping additive, including proper procedures, worker information, use of

protective clothing and equipment, removal of sensitive workers, site supervision and contingency system.

The Contractor shall advise workers of the proper procedures to be followed when working with asphalt cement or asphalt concrete containing liquid anti-stripping additive.

The Contractor shall ensure that Carriers retained to haul the asphalt cement containing liquid anti-stripping additive have received training with respect to working with asphalt cement containing liquid anti-stripping additive.

The Department shall provide training with respect to working with asphalt cement or asphalt concrete containing liquid anti-stripping additive for its employees or representatives.

**4.3.2.2 Mandatory Respiratory Protection.** The Contractor shall provide at their expense Respiratory Protective Equipment for any of their staff that are directly exposed to the concentrated vapours of asphalt cement containing liquid anti-stripping additive (unless exhaust ventilation is provided) such as those who may be subjected to the plume from the asphalt cement storage tank. The Contractor shall ensure that these staff wear the Respiratory Protective Equipment. (The Department shall provide at its expense similar protective equipment for its employees or representatives and shall ensure that the protective equipment is worn.)

**4.3.2.3 Voluntary Respiratory Protection.** The Contractor shall provide upon the request of its employee, and at the Contractor's expense, Respiratory Protective Equipment for any of their employees who feel they are adversely affected (eye, nose, throat, lung irritation, nausea, etc.) by the odors of the asphalt concrete containing liquid anti-stripping additive. (The Department will provide at its expense and upon request similar protective equipment for its employees or representatives.)

**4.3.2.4 Respiratory Protective Equipment Specifications.** Respiratory Protective Equipment shall consist of a full face mask, to protect eyes as well as respiratory system, and shall be equipped with organic vapour cartridges and dust pre-filters. Cartridges shall be replaced whenever the smell of vapours is detected by the worker using the respirator. Pre-filters shall be replaced when they become visibly dirty or when resistance to breathing becomes noticeable.

**4.3.2.5 Relocation of Worker Sensitive to Liquid Anti-Stripping Additive When Wearing Respiratory**

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**Protective Equipment.** The Contractor shall, at the request of a worker adversely affected by the vapours of asphalt cement containing liquid anti-stripping additive or the odours of asphalt concrete containing liquid anti-stripping additive (who cannot be adequately protected by wearing respiratory protective equipment) relocate the worker to work in an area where the worker is not affected.

If the Contractor recognizes that a worker adversely affected, the Contractor shall relocate that worker to work in an area where the worker is not affected.

The Department will, at the request of an employee adversely affected by the vapours of asphalt cement containing liquid anti-stripping additive or the odours of asphalt concrete containing liquid anti-stripping additive (who cannot be adequately protected by wearing respiratory protective equipment) relocate the employee to work in an area where the employee is not affected. Relocating a Department employee sensitive to anti-stripping vapours may result in minor delays to the paving operations.

If the Department recognizes that a worker is adversely affected, the Department will relocate that worker to work in an area where the worker is not affected.

**4.3.2.6 Monitoring of Air Quality.** The Department will, at its expense on some contracts, monitor the air quality at various locations of the paving operations. The Contractor shall cooperate with respect to this testing, by providing access to all aspects of the paving operation to the Department or its representative.

**4.3.2.7 Contingency System.** The Contractor shall have an employee on site who will be authorized (this employee shall be identified at the pre-construction meeting) to make decisions regarding any difficulties that may arise during the paving project.

**5.0 CONSTRUCTION METHODS****5.1 Manufacturing Mix**

**5.1.1 Hot Mix Plants.** All manufacturing shall be done with either a batch, drum or continuous mixing plant. All plants shall conform to the requirements of ASTM D995 and as specified herein. The Contractor shall ensure that the hot mix plant is operating properly so that unburned burner fuel does not contaminate the asphalt concrete.

**5.1.1.1 Cold Bins.** Cold bins for all mixes shall be divided into not less than three compartments. Each compartment shall be equipped with its own gate control to enable accurate proportioning of each aggregate. Dimensions of each compartment shall be

such that free flow of aggregate can be attained at all times. Contamination of the aggregate designated to be placed in each compartment before or after placement in the bins shall be cause for rejection of the material.

If the cold bins are being fed with a front end loader the Contractor shall ensure that there is no spillage from the loader bucket such that aggregate of one size is spilled into a bin containing aggregate of a different size.

**5.1.1.2 Feed for Dryer.** The plant shall be provided with mechanical means for uniformly and accurately feeding aggregate into the dryer so that a consistent mixture and temperature can be achieved.

**5.1.1.3 Dust Collector.** The plant shall be operated so that emissions are in accordance with the 'Asphalt Paving Plant Regulations'.

**5.1.1.4 Asphalt Cement Storage Tanks.** Storage tanks shall be insulated and equipped with heaters to maintain the asphalt cement at the spraying temperature given in Division 4 Section. Each tank shall be equipped with thermometric equipment that indicates within 5°C, the actual temperature of the asphalt cement. Safe and easy access shall be provided to the hatch to facilitate sampling and measuring the level of asphalt cement in the tank(s). The Contractor shall be responsible to supply an acceptable device for measuring the level of asphalt cement and an accurate calibration chart for each tank. The Contractor shall ensure that contamination of the mix does not occur through the introduction of heating oil. The use of hydrocarbon fuels or solvents to flush hoses and/or pumps shall not be permitted.

**5.1.1.5 Sampling Stand.** The Contractor shall provide, install and maintain a stand for the purpose of sampling asphalt concrete from loaded trucks. It shall be of solid construction, safe, firmly anchored, of a height to enable easy acquisition of samples from the haul vehicles. The stand shall have a platform of minimum dimensions area of 3 m in length and 1 m in width, be equipped with stairs and be completely enclosed with guard and hand rails and it shall be placed in a suitable location.

**5.1.1.6 Production Rate.** Plants shall be operated at a rate which allows them to produce high quality mix, consistent with the Manufacturers recommendations. They shall also be operated at a rate to provide continuous operation compatible with the rate of placing the mix.

**5.1.2 Batch and Continuous Mix Plants.** In addition to the general requirements in Subsection 5.1, the

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following shall apply:

**5.1.2.1 Aggregate Preparation (See also Sections 6.2.1, 6.2.2 and 6.2.3).** Aggregate shall be fed to the cold bins from approved stockpiles and not directly from the crusher. Feed from the cold bins to the dryer shall be in proper proportions and at a rate to permit uniform temperature control. The aggregate shall be dried and transported to the pugmill at a temperature between 135°C and 160°C. The actual temperature shall be determined based on the penetration grade of the asphalt cement, the ambient temperature and workability, but shall be as low as possible to permit proper mixing, placing, compacting and finishing.

Immediately after heating, the aggregate shall be screened into bins with separation on the 5000 sieve and such other coarse sieve sizes as the number of bins permit.

The quantity of aggregate in stockpile at the asphalt plant site during periods of mix production shall be at least equal to the amount required for 20 hours of mix production or the quantity required to complete the job.

**5.1.2.2 Proportioning and Mixing.** Each size of aggregate and the asphalt cement shall be measured separately and accurately in the proportions in which they are to be mixed. The depth of material in the pugmill shall be set so that there are no dead areas and the asphalt concrete is uniformly mixed.

In batch plants, dry mixing shall be for 15 seconds and after even distribution of the asphalt cement, a minimum of 30 seconds wet mixing, or according to the manufacturers specification.

Continuous mix plants shall have a minimum mixing cycle as calculated by the formula in ASTM D 995, but no less than 45 seconds.

Provision shall be made to waste all of the dust or to uniformly return any or all of the dust as required to meet the specifications.

**5.1.3 Drum Mix Plants.** In addition to information in Section 5.1.1, the following shall apply:

**5.1.3.1 Aggregate Preparation (See also Subsection 4.1.7).** Continuous testing of the aggregate produced during the crushing operations shall be performed and upon completion of crushing of the initial 1500 t of fine aggregate and 1500 t of coarse aggregate, a mean value for percent passing the 5000 sieve for each shall be determined. The mean values are referred to as design values. Aggregates crushed henceforth must have gradation within 5% of the design values and also comply with the 80% requirement in Subsection 4.1.7.

**5.1.3.2 Cold Feed System.** Each cold feed bin shall be adjusted and calibrated to the manufacturer's specification; have partitions adequate to prevent the intermingling of aggregate; feed only one aggregate size through a fully adjustable gate; and have the belt conveyor controlled remotely by variable speed motors that will permit precise speed adjustment.

A belt scale shall be provided on the cold feed conveyor and shall be calibrated to the manufacturer's tolerance at the start of each project, or whenever the weighing conveyor is moved or when deemed necessary by the Engineer. The weighing conveyor shall be equipped with a self-cleaning system to eliminate weighing errors. The belt conveyor shall be set at the tension recommended by the manufacturer.

A positive interlocked automatic shutoff shall be provided so that the plant will shut down automatically after a 15 second delay or if there is a disruption in the flow of aggregate.

A vibratory scalping screen of adequate size and capacity shall be provided to remove oversize material from the combined cold feed belt. Provision shall be made to divert the aggregate passing the vibrating screen to allow sampling by the Department or its representative. Monitoring probes shall be installed to monitor the moisture in the aggregate.

**5.1.3.3 Asphalt Cement Distribution.** The asphalt cement delivery system shall be equipped with a flow switch which shall automatically stop the plant if any interruption occurs in the flow of asphalt cement. A temperature correction device shall be used to compensate for the specific gravity of the asphalt cement. The system shall be equipped with a bypass to permit weighing and calibration.

**5.1.3.4 Calibration.** The Contractor shall have competent personnel available to calibrate and maintain all electronic, electrical and mechanical controls.

The Contractor shall maintain at the plant a copy of the manufacturer's manual which contains the method of calibrating which shall be used to perform the initial calibration after assembly and prior to production. The calibration of the plant shall be carried out under the supervision of the Department or its Representative.

Generally initial calibration shall consist of cold feed and asphalt cement metering pump calibration. Each cold bin shall be calibrated separately by diverting the flow from the bin into a properly tared truck. The asphalt cement metering pump shall be calibrated by diverting the flow into a tared tank truck.

Graphs shall be prepared for each bin showing the flow

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in tonnes per hour (tph) (moisture corrected) plotted against the plant readout for the variable speed motors. A graph shall also be prepared showing the tph of asphalt cement plotted against the plant readout for the pump.

When an aggregate source is changed, the cold feed system shall be calibrated. At the start of each day the assembly shall be stabilized. A known mass shall be placed on the weighing conveyor to verify the plant readout. During production, the moisture content of each aggregate in the cold feed bins shall be determined before noon and also after noon. Changes will be made in the plant settings due to changes in moisture. Adjustments shall be made until all plant settings agree with design tph and the tph from the calibration graphs.

**5.1.3.5 Production.** The Contractor shall supply to the Project Engineer at the project pre-job meeting, the asphalt plant manufacturer's specification for each individual plant;

- the specified rate of production in tonnes per hour versus aggregate moisture content, the Contractor shall adhere to the manufacturer's production rates
- the specified location of the asphalt cement delivery pipe within the drum of the asphalt drum mix plant
- production will not commence until the location of the asphalt cement delivery pipe is verified by visual inspection at the start of the paving season or as deemed necessary by the Department
- deviations from the manufacturer's specification will not be permitted

The aggregate shall be sufficiently dried as evidenced by the lack of noticeable steaming and bubbling of the asphalt concrete, and by the absence of any visible free water seepage from the storage silo, or the truck bodies. If any of these conditions are evident it shall be cause for rejection of the asphalt concrete.

A system for diverting unacceptable material shall be provided between the drum and the storage silo or surge bin. The moisture content of the asphalt concrete at discharge shall be determined daily and shall not exceed 0.5%. The temperature of asphalt concrete shall be automatically recorded.

**5.1.3.6 Storage.** Drum mix plants shall be equipped with either a silo or a surge bin, capable of delivering a homogenous, non-segregated and non-contaminated asphalt concrete into the trucks. Silos shall be maintained at least half full and be equipped at the top with a tripping hopper. The silo shall be equipped with a device to indicate if the silo is half full.

The tripping hopper shall be coordinated with plant production and shall close before complete discharge

to prevent any free fall of asphalt concrete into the silo. Storage in the silo up to 20 hours shall be permitted provided that the penetration of the asphalt cement recovered from the stored asphalt concrete is equal to or greater than the penetration after the thin film oven test of the original asphalt cement before mixing and also the temperature remains such that the asphalt concrete does not arrive at the paver below 125°C.

**5.2 Loading, Transporting, Unloading.** Asphalt concrete shall be discharged from the plant into truck bodies using a minimum of three drops to fill the body. The truck shall be repositioned between drops such that the first drop is toward the front of the box, the second drop is toward the rear of the box, and the third drop is in the middle.

At no time shall the asphalt concrete be allowed to trickle through the surge bin or silo into the truck body. Asphalt concrete shall be transported from the paving plant to the work site in vehicles with smooth metal bodies, free from leaks and previously cleaned of all foreign materials. Vehicles shall be equipped with tarpaulins of water repellant material with a maximum mesh size of 0.5 mm when stretched, a minimum melting point of 200°C and of sufficient size to completely cover truck bodies from edge of box to edge of box and overlap the tailgate. Tarps shall be in good condition and shall have no holes or tears. The tarps shall be securely tied down so there is no visible opening between the truck box and tarp. Vehicles shall also be equipped with wind deflectors at the front of the truck box. If it is raining or if the temperature of the asphalt concrete drops more than 10°C between the time of leaving the plant and placing on the road, tarpaulins shall be used. Tarpaulins shall be used at any other time at the Engineer's request.

The use of Hydrocarbon fuels or solvents to lubricate the truck bodies or to clean tools or equipment, will not be permitted. A biodegradable release agent shall be supplied by the Contractor to clean or lubricate tools, equipment and truck bodies.

Trucks will stop slightly ahead of the paver and the paver will move ahead and smoothly pick up the truck. To reduce segregation, prior to backing into the spreader the truck body shall be partially elevated before the tail gate is tripped to promote a mass of material deposited in the hopper.

**5.3 Placing.** Asphalt concrete shall be placed upon a prepared surface which is free from standing water and cleaned of all loose or foreign material.

On repaving projects, before placing of new pavement, the existing pavement shall be tacked as per Division 4,



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**Section 1, Emulsified Asphalt.** When the pavement has been left over the Winter, it shall be cleaned and tacked before new pavement is placed.

New pavement may be applied directly over a freshly placed mat without applying tack coat, such as when multiple lifts are being placed within the same construction season.

Placement shall not take place during rain, or when the surface is frozen, nor when the ambient temperature is below 5°C, unless otherwise directed by the Engineer.

The placing of asphalt concrete shall be at a constant and even rate of speed.

The spread rate for each lift shall not vary more than 15 kg/m<sup>2</sup> from that specified by the Engineer. The maximum spread rate allowed will be 135 kg/m<sup>2</sup> unless otherwise approved by the Engineer.

**5.3.1 Mechanical Pavers & Their Operation.** Unless otherwise permitted by the Engineer, the asphalt concrete shall be spread by a mechanical self-powered paver in good working condition capable of achieving the specified grade, line and crown.

Pavers shall be equipped with hoppers and reversing distributing screws to place the asphalt concrete evenly in front of adjustable screeds. The asphalt concrete shall be dumped in the centre of the hoppers such that no spilling occurs on the road surface. Any asphalt concrete spilled accidentally shall be shovelled from in front of the spreader and wasted or placed in the hopper. The hopper shall not be emptied to less than 25% of capacity while moving forward except when the spreading operation is being suspended (i.e. as the end of the day). Wings of the paver shall only be dumped when the asphalt concrete has built up so that a truck cannot be unloaded. Any cold or segregated material must be shovelled out and wasted.

Any segregated asphalt concrete in the hopper shall be shovelled out between truck loads and wasted. The distributing screws shall always be kept between 1/3 and 2/3 covered. Pavers shall employ equalizing runners, straightedge runners, even-arms and/or other compensating devices to adjust the grade and confine the edges of the asphalt concrete to the true lines without the use of stationary side forms. They shall be capable of spreading the asphalt concrete without segregation, to a thickness between 20 mm and 100 mm and in instances where a single paver is operating, that paver must be capable of continuous width adjustment. When paving in echelon one of the pavers must be capable of continuous width adjustment. Where a single paver is operating on a surface course, the width of paver shall be such that a longitudinal joint

is not formed within a travel lane. The joints in the lower courses may be in the travelled lane but not directly in the wheel path. Longitudinal joints between courses shall be offset by a minimum of 300 mm.

Pavers shall be equipped with adjustable vibrating screeds which are capable of being heated and produce a minimum vibrating frequency of 3000 vibrations per minute or as specified by the manufacturer. They shall be equipped with a maintained strike-off bar or tamper. The tamper shall knead the coarse particles to prevent tearing or dragging of the mat. The vibrating screed, including extensions, will provide initial compaction and must form a consistent texture and grade and shall operate across the entire width of the mat.

Immediately after the asphalt concrete is spread and before rolling operations begin, the surface shall be inspected and any irregularities repaired and adjustments made to the screed. Irregularities in alignment and grade along the outside edge shall also be corrected before the edge is rolled.

Special attention shall be given to the straight edging of each lift following initial rolling.

Approved automatic screed controls shall be used to regulate longitudinal grade and transverse slope when spreading Type B, Type B-HF, Type C, or Type C-HF on Freeways and/or Arterials.

Automatic screed controls shall be used on Collector or Local roadways at the mutual agreement of the Engineer and Contractor or if specified in the Special Provisions.

All pavers must be equipped with automatic joint matchers which shall be used to match to the grade of a previously placed adjacent mat.

Automatic screed controls for the control of longitudinal and transverse slope and joint matching shall be as recommended or supplied by the manufacturer of the paver. When use of the longitudinal automatic screed control is specified the first lift shall be controlled as to grade by an approved 9 m ski or floating beam. For all subsequent lifts the paver shall match the previous lift by using the shoe designed for that purpose.

**5.3.2 Spreading Alternatives.** In narrow base widening, deep or irregular sections, intersections, turnouts, or driveways, where it is impractical to use mechanical pavers to spread and finish the base, levelling or surface course, the Contractor may use other approved spreading equipment (graders etc.) or hand methods as directed by the Engineer.

When the asphalt concrete is to be spread by hand, it

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shall be dumped and then spread with lutes or rakes. The Contractor will not be permitted to use shovels to spread the asphalt concrete by broadcasting it over the surface. Any part of the asphalt concrete that has formed into lumps and does not break down easily shall be discarded. The rakers will not be permitted to stand on the hot asphalt concrete, except where necessary to correct errors in the first raking. The hand placement and raking shall be performed in such a manner that a minimum amount of patching will be required.

**5.3.3 Joint Construction.** All joints shall be well bonded to form a continuous seal.

**5.3.3.1 Transverse Joints.** Transverse joints shall be formed by butt joints. When forming butt joints, the edge of the previously placed asphalt concrete shall be cut back to its full depth so as to expose a fresh surface after which it shall be coated with hot asphalt cement or tack coat or heated before fresh asphalt concrete is placed in contact with it. Heat shall be applied to the joint using a method approved by the Engineer with care taken not to overheat the existing asphalt concrete. The freshly placed asphalt concrete shall be raked to the proper depth and grade and then the transverse joints shall be rolled transversely (perpendicular to the travel lanes) and the compacted joint shall be inspected with a 3 m straightedge. If there is more than a 6 mm depression, the joint shall be reconstructed.

**5.3.3.2 Keyed Joints.** When overlaying existing asphalt concrete pavement, keyed joints (see Drawing HS404.DWG) shall be constructed at both ends of the Project repaved area, at all intersecting roads, ramps and at all bridge decks in the repaved area, to avoid a feather joint. Keys will only be required between the final lift of pavement and the existing pavement, unless otherwise directed by the Engineer.

The existing asphalt concrete pavement shall be removed to expose a vertical surface of a depth equal to the thickness of the final lift against which new asphalt concrete may be placed. The minimum slope measured parallel to the centre line of the milled area shall be 200 horizontal to 1 vertical (200H:1V). The angle that the joint makes with the centerline shall not exceed forty five (45°) degrees or as otherwise directed by the Engineer.

When existing pavement has been removed in advance of paving the joint area, the Contractor shall construct a smooth taper at the joint area to a slope of at least 50 horizontal to 1 vertical (50H:1V). The taper may be placed on tar paper and shall be removed just prior to paving the keyed area or as directed by the Engineer. The transverse joint shall be straight and have a vertical face when the taper is removed.

The associated cost of providing all keys shall be included in the price per tonne of asphalt concrete.

The paver shall not move more than 20 m from any transverse joint until that joint has been rolled and checked with a straight edge. If the joint is not satisfactory it shall be immediately corrected before the paver may proceed.

**5.3.3.3 Longitudinal Joints.****5.3.3.3.1 Paving in Echelon**

**5.3.3.3.1.1 Paving / New Construction.** Pavers shall be used in echelon to lay the mat full width. The pavers shall follow one behind the other so closely that cooling of the longitudinal joints between the mats is not permitted. 

Adjacent mats must be completed to provide for exposed joint edges of maximum length of 100 m at the end of each day.

**5.3.3.3.1.2 Pulverization / Repaving Projects.** Pavers may be used in echelon to lay the surface full width, when practical, when traffic can be diverted and when production of the mixture can be maintained. The pavers shall follow one behind the other so closely that cooling of the longitudinal joints between the mats is not permitted. 

Adjacent mats must be completed to provide for exposed joint edges of maximum length of 100 m at the end of each day.

**5.3.3.3.2 Conventional Paving**

**5.3.3.3.2.1 Construction When not Paving in Echelon.** Prior to placing the adjacent mat, the exposed edge of each longitudinal joint must be coated with emulsified asphalt (tack coat). 

The material being placed in the abutting lanes shall be tightly crowded against the vertical face of the previously placed lane. The paver shall be positioned so that in spreading, the material overlaps the lane previously placed by 25 to 50 mm and should be left sufficiently high to allow for compaction. The width and depth of the overlapped material shall be kept uniform at all times.

The longitudinal joints may be constructed such that the freshly placed asphalt concrete may be humped by the back of the rake or lute which shall permit the roller to force and compact the asphalt concrete into the previously placed lift. During construction of the



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longitudinal joint, the rakers will not rake the coarse particles over the freshly placed asphalt concrete. Any surplus of coarse particles shall be wasted.

When constructing a joint near any adjoining edge that the spreader cannot reach, any spaces left open shall be filled by hand with asphalt concrete. This may be humped with the back of a rake or lute to a proper height as to receive maximum compaction.

Longitudinal joints in the top lift shall not be constructed within a travel lane except when paving in echelon or when paving tapers. Lower mats may have joints in the lane but not in the wheel path. Joints in succeeding lifts shall be offset a minimum of 300 mm.

Adjacent mats must be completed to provide for exposed joint edges of maximum length of 100 m at the end of each day.

In no case, shall a section of longitudinal joint be left exposed for greater than three (3) hours, that is, the adjacent mat must be placed along any section of previously placed mat within three (3) hours. The exception to the foregoing is the short (100 m or less) strip that may be exposed at the end of the day.

**5.3.4 Placing Rate.** Placing shall proceed in a continuous and steady manner. The paver speed shall therefore be regulated to the rate of plant production, however, placing must be at such a rate to provide for a satisfactory finish and specified compaction.

Ordinarily, there shall not be more than five (5) trucks waiting to unload ahead of the spreader.

**5.4 Compacting and Finishing.** The minimum density acceptable shall be 94% of the Theoretical Maximum Relative Density determined according to ASTM D 3203. The percent compaction shall be determined by comparing the core densities with the theoretical maximum relative density.

**5.4.1 Rolling Operations - General.** Compaction of the asphalt concrete shall be with any combination of rollers that can achieve the specified smoothness and density except that when compacting Type B-HF or Type C-HF, a pneumatic tired roller shall be used in the train. Also, there shall be at least one pneumatic tired roller in the train when it is determined specified compaction cannot be obtained or surface texture and smoothness acquired.

The Contractor shall demonstrate a rolling pattern for achieving compaction at the start of paving operations and the degree of compaction will be verified by the

Department. This rolling pattern shall be maintained unless a change is approved by the Engineer.

When ending a pass, the roller shall turn to one side to avoid leaving a depression perpendicular to the centerline.

To avoid depressions in the asphalt concrete, rollers shall not be permitted to park on the hot mat.

All pneumatic tired rollers shall be skirted when air temperature is 10°C or lower or at the Engineer's request. When thin lifts are being placed, particularly if the air temperature is 10°C or lower, the plant production shall be reduced to allow for specified compaction procedures.

**5.4.1.1 Rollers - General.** Rollers shall be in good condition, capable of reversing direction without backlash and they shall be operated by competent and trained operators. The speed of steel wheeled rollers and pneumatic rollers shall not exceed 5 km/h and 8 km/h, respectively. The speed shall be slow enough to avoid displacement of the asphalt concrete. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause shall be corrected. Rolling shall proceed continuously until all roller marks are removed and the specified compaction is achieved. Water or a biodegradable release agent shall be used on the roller wheels or tires to prevent adhesion of asphalt concrete. Hydrocarbon fuels or solvents shall not be permitted. Pneumatic tired rollers shall have a minimum mass of 3.5 t/m of width of tread. Vibratory rollers shall be capable of operating at a frequency of 2000 impacts per minute. The Department may use a tachometer to inspect the vibration frequency of each roller.

**5.4.1.2 Number of Rollers.** The minimum number of rollers to be supplied by the Contractor shall be as shown below unless the Contractor is able to achieve the required density, surface texture, and smoothness with fewer rollers.

| Plant Output, t/h | Rollers (minimum) |
|-------------------|-------------------|
| 80                | 2                 |
| 120               | 3                 |
| 180               | 4                 |
| 240               | 5                 |
| 300               | 6                 |

**5.4.1.3 Breakdown Rolling.** Breakdown rolling shall begin when the asphalt concrete can withstand the mass of the roller without excessive displacement. Delays in rolling will not be tolerated. Rolling shall start longitudinally at the lower side or unsupported edge and proceed towards the centre of the mat, overlapping on each successive pass, by at least one half of the

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width of the drum. Alternate passes shall be of varying lengths. At unsupported edges, the roller shall cover the edge, but shall not overhang the edge by more than 150 mm.

**5.4.1.4 Secondary Rolling.** Secondary rolling shall follow the breakdown rolling as closely as possible while the asphalt concrete is still viscous enough to achieve the specified compaction.

**5.4.1.5 Final Rolling.** Final rolling shall be performed while the asphalt concrete is still viscous enough to permit the removal of roller marks.

**5.4.1.6 Vibratory Rolling.** Vibratory rollers shall be operated at a travel speed and vibration frequency to produce a minimum of 25 impacts per metre. Vibratory rollers will be used at the low amplitude setting, unless compaction cannot be achieved in which case the high amplitude setting will be used provided it does not cause ripples in the surface. Vibratory rollers shall be equipped with a device to provide for automatic shut off of vibration before the roller comes to a stop.

Vibratory compaction shall not be used on bridge decks.

**5.4.1.7 Compaction Near Structures.** Along curbs, headers, manholes and other structures not accessible to the roller, compaction must be obtained by employing suitable tampers or compactors.

**5.4.2 Surface Finish.** The surface, after final rolling shall be smooth and true to the established crown and grade.

All defective areas shall immediately be repaired by removing the asphalt concrete and replacing it with the same type of hot mix asphalt concrete used in that particular lift as per the specifications.

The surface shall be free from roller marks or any depressions exceeding 6 mm when measured with a 3 m straight edge held parallel to the centerline.

The surface shall have a cross slope of 20 mm/m to 35 mm/m as specified by the Engineer (in areas of normal crown).

**5.5 Illumination.** Asphalt concrete shall be transported, spread and compacted during daylight hours unless artificial light satisfactory to the Engineer is provided.

**5.6 Temperature of Asphalt Concrete.** Asphalt concrete exceeding a temperature of 165°C at any point of the operation shall be cause for rejection.

**5.7 Co-ordination.** All Aspects of the operation shall be co-ordinated such that production, transportation, placing and compaction shall be in a steady and continuous manner.

**5.8 Segregation, Damage, Contamination.** Segregation, damage or contamination of the asphalt concrete shall not be permitted whether it occurs in the stockpiles, mixing drum, conveyors, silos, surge bins, discharge chute, trucks or spreader or any other equipment. Segregated material shall be removed immediately as soon as it becomes apparent at any stage of the operation. Areas of segregated, damaged or contaminated material shall be removed to the full depth of the lift and repaired, to the satisfaction of the Engineer, at the Contractor's expense.

Equipment shall not be refuelled on the new asphalt concrete.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Inspection.** The Department will have a representative at the site of aggregate production, at the asphalt plant site and on the road. The Contractor is responsible to provide free and safe access to the site(s) to permit the Department's representative to carry out required duties.

The Contractor shall supply an inspection facility both at the aggregate production site and asphalt plant site for the Department's representative and at the Contractor's expense. The location of this facility shall be close to the plant or production site which allows a clear view of the operation and shall be in an environmentally acceptable area. At the aggregate production site and the asphalt plant site, a reservoir of 100 L. of water suitable for performing tests shall be supplied. At the asphalt plant site an electrical connection will be supplied.

**6.1.1 Inspection Quarters - Asphalt Plant.**

- outside dimension - 2400 mm x 4270 mm (minimum)
- walls and ceiling to be insulated
- one 920 mm door with window and lock
- two windows, (minimum 700 mm x 600 mm) shall open

**Furniture, Equipment, Utilities**

- one air conditioner
- base board heat
- electricity capable of supporting electronic equipment, air condition, heat, etc.
- two overhead lights
- one sink draining into holding tank
- one bench A along 4270 mm wall -- dimension 760 mm wide by 900 mm high. One bench B along 2400 mm wall - dimension 760 mm wide

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- by 900 high (shall be of sturdy construction and well supported).
- five wall plugs - three plugs located on bench A and two plugs on bench B
- steps providing safe access
- supply of water for testing purposes (not necessarily to be running water)
- two chairs

**6.1.2 Inspection Quarters - Aggregate Production Site.**

- outside dimension 2 m x 2 m minimum
- one door
- one window
- one bench
- one chair
- supply of water for testing purposes

**6.2 Sampling and Testing of Aggregate.**

**6.2.1 Minimum Production Prior to Sampling.** The Department will sample and test the proposed sources according to ASTM D 75 after 1000 t of aggregate have been stockpiled (500 t of coarse and 500 t of fine). ASTM C 136 and ASTM D 546.

**6.2.2 Testing During Production.** In pits where aggregate is being produced during construction, the aggregate shall be continuously sampled and tested according to ASTM D 75, ASTM C 136 and ASTM D 546.

**6.2.3 Testing Stockpiled Aggregate.** In high volume operations such as in a quarry where at least 3000 t of stockpile already exist, the aggregate in the stockpile shall be sampled and tested as per ASTM D 75, C 136 and D 546.

**6.2.4 Aggregate Sampling for Stripping Test.** Sampling of aggregates for the stripping test shall be as outlined in Subsections 6.2.1, 6.2.2 and 6.2.3.

**6.3 Sampling Asphalt Cement.** A sample of asphalt cement, as per ASTM D 140, shall be taken from each tanker load delivered according to ASTM D 140. The sample is to be not less than 1 L, placed in clean, air tight containers. The Department reserves the right to

request samples from the storage tanks at any time.

**7.0 METHOD OF MEASUREMENT**

The Contractor shall, at their expense, provide, install and maintain such approved scales and all suitable facilities as may be required to enable the Engineer to determine accurately the weight of asphalt concrete loaded into each truck.

**8.0 BASIS OF PAYMENT**

**8.1 General.** Asphalt concrete will be paid for at the contract unit price per tonne for the quantity incorporated and accepted in the work which price shall be full compensation for furnishing of all materials (except asphalt cement which will be compensated for as per Division 4 Section 2 or as per the contract Special Provisions and the hauling of blend sand up to 10% of the total mix, when required as per the guidelines of Subsection 3.2, and for heating, handling, mixing, weighing, transporting, placing, compacting and the supplying of all equipment, plant, labour and incidentals necessary to complete the work herein specified.

The unit price per tonne will be subject to adjustments if specified in the Special Provisions (example smoothness). Aggregate in stockpile will be paid for under the conditions and at the rate indicated in the Special Provisions.

**8.2 Hauling of Blend Sand.** The hauling of blend sand will be paid for if the blend sand is still required when the design procedure contained in Subsection 3.2 has been followed. The amount of blend sand eligible for haul payment shall be the actual tonnage of blend sand used, or up to 10% by mass of the total mix in which the blend sand was required. Haul rates to be paid shall be the lesser of the actual haul rates paid by the Contractor, or DOT&PW haul rates. Documentation showing the actual haul rates shall be provided to the Engineer.

**9.0 WARRANTY**

## Division 4 Pavements

## Section 5 Liquid Asphalt Primer

## SECTION 5 - LIQUID ASPHALT PRIMER

## 1.0 DESCRIPTION

This item shall include the supply, transportation and application of all primer used on the contract.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 5, Test Method for Penetration of Bituminous Materials
- ASTM D 113, Test Method for Ductility of Bituminous Materials
- ASTM D 140, Practice for Sampling Bituminous Materials
- ASTM D 402, Test Method for Distillation of Cut-Back Asphaltic Products
- ASTM D 2042, Test Method for Solubility of Asphalt Materials in Trichloroethylene
- ASTM D 2170, Test Method for Kinematic Viscosity of Asphalts
- Division 4 Section 1, Emulsified Asphalt

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Notice of Supply.** Bidders shall nominate their source of primer and provide Statement of Supplier's price for primer as a supplement to the tender. On the form "Statement of Asphalt Cement, Liquid Asphalt - Primer and Emulsified Asphalt -Tack", Bidders shall:

- Submit with their tender a statement as to the source of primer. The Bidder shall only nominate one source of supply of primer.
- Indicate the Supplier's Posted Rack Price for primer FOB refinery (excluding taxes). For confirmation, the Bidder shall attach the written price quotation from the Supplier, which price shall be effective at time of award of contract and shall remain in effect until the end of the current calendar year.

No tender will be considered that does not include the above information.

**3.2 Contracts Completed in Calendar Year.** In the event that the Contractor wishes to change the source of supply during the progress of the contract, the Contractor shall apply for approval in writing, to the

District Director. Approval in writing must be given by the District Director before the source of supply is changed.

The Contractor will not be compensated for any increase in cost of primer in the calendar year in which the primer work was initially intended to be done.

**3.3 Contracts Carried Over to the Next Calendar Year.** In the event the Supplier's Posted Rack Price increases or decreases subsequent to the end of the calendar year in which the primer work was initially scheduled and one of the following conditions is satisfied, then a price increase or decrease will be considered:

- In the opinion of the Department, a delay caused by another Contractor working on the contract site adversely affects the start up date of this Contract resulting in the completion of priming being delayed until the following year; or
- In the opinion of the Department, the lateness in tender call makes it unreasonable for the Contractor to finish priming that year. This will be noted in the Special Provisions of the contract; or
- In the opinion of the Department, for reason(s) beyond the control of the Contractor, the priming could not be completed before the end of the calendar year in which the priming was initially intended to be completed.

If the request for a price increase or decrease is approved by the District Director the Contractor will be assessed an increase or decrease for an amount equal to the actual dollar difference between the Supplier's original Posted Rack Price quotation and the Supplier's new Posted Rack Price. In all cases the Supplier's Posted Rack Price quotation for the price of primer for the next calendar year shall be submitted to the Engineer before the Contractor will be paid for any primer used that year. Any claim for a price difference by the Contractor shall be supported by the Supplier's Posted Rack Price.

## 4.0 MATERIALS

The liquid asphalt shall conform to the requirements listed in the following Table 4.5.1.



## Division 4 Pavements

## Section 5 Liquid Asphalt Primer

Table 4.5.1 - Primer Requirements

| Requirements                                               | Min  | Max | ASTM   |
|------------------------------------------------------------|------|-----|--------|
| Kinematic Viscosity<br>@ 60°C, mm <sup>2</sup> /s          | 20   | 35  | D 2170 |
| Distillate (% of total<br>distillate to 360°C)<br>to 190°C | 20   | 80  | D 402  |
| to 225°C                                                   | 40   | --  |        |
| to 260°C                                                   | 70   | --  |        |
| to 315°C                                                   | 85   | --  |        |
| Residue to 360°C,<br>volume % by<br>difference             | 50   | --  | --     |
| Residue<br>Penetration @ 25°C,<br>100 g, 5s, 0.1 mm        | 80   | 200 | D 5    |
| Ductility @25°C 5<br>cm/min, cm                            | 100  | --  | D 113  |
| Solubility, % by mass                                      | 99.5 | --  | D 2042 |

## 5.0 CONSTRUCTION METHODS

**5.1 General.** When spraying primer, the Contractor shall cover concrete walks, curbs and walls adjacent to the highway with paper or other satisfactory covering and shall remove any primer which adheres to this concrete. No additional compensation will be allowed to the Contractor for this work.

**5.2 Application Method.** The Contractor shall place the primer at a rate of not less than 1000 ml/m<sup>2</sup> at a temperature of not less than 30°C nor more than 45°C. Primer shall not be applied in wet conditions, at an ambient air temperature lower than 7°C, or under other adverse conditions based on the approval of the Engineer. The primer shall be allowed to penetrate for such time as the Engineer directs. If possible, traffic shall be diverted around freshly primed surfaces. Asphalt concrete shall not be placed upon a primed surface for a minimum of 48 hours after the application, or as directed by the Engineer. Primed surfaces shall be rolled with steel wheeled rollers, weighing not less than 7 t. Rolling shall take place within 4 hours of application of primer, unless otherwise specified by the Engineer. If surface defects develop in the primer prior to asphalt concrete placement, the Contractor shall repair such defects as directed and at their own cost.

**5.3 Application Equipment.** All applications of primer

shall be made by means of an approved distributor conforming to that specified in Division 4 Section 1 of these specifications. Primer shall be sprayed in a uniform manner and rate as directed and over a width, if required, of not less than 5 m. The forward speed of the distributor shall not exceed 100 m/min. The application of primer shall terminate at the same station for both lanes at the end of each day.

**5.4 Storage Tankers and Tanks.** Tankers used to transport primer or tanks used for temporary storage shall meet the following requirements:

- Be free from hydrocarbon fuels or solvents, such as diesel, varsol, gasoline, etc;
- Have a sampling spigot as outlined in ASTM D140;
- Be equipped with thermometers, accurate and capable of reading to the nearest 2°C.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Notification of Deliveries.** To ensure that the Department has someone available to carry out sampling (in accordance with ASTM D 140), it shall be a requirement that the Contractor notify the Engineer of the approximate time of delivery of all loads. For loads that are to be delivered after the plant operation hours on normal work days, the Contractor shall give the Engineer notification prior to 4:00 p.m. on the day of delivery. Notification of weekend deliveries shall be given to the Engineer before 4:00 p.m. on Friday. Whenever practical, deliveries should be scheduled to take place during hours of plant operation.

**6.2 Deficiencies.** Any contamination or nonconformance of the product to the requirements as specified in Table 4.5.1 of this specification shall be corrected to the satisfaction of the Engineer at no cost to the Department.

## 7.0 METHOD OF MEASUREMENT

The volume of primer shall be calculated at a temperature of 15°C.

## 8.0 BASIS OF PAYMENT

The liquid asphalt will be paid for at the contract unit price for primer per litre in place, which price shall be full compensation for supplying, heating, handling, transporting and applying of this material and for the supplying of all equipment, plant, labour and incidentals necessary to complete the work herein specified.

## 9.0 WARRANTY



**Division 4 Pavements****Section 6 Removal of Asphalt Concrete****SECTION 6 - REMOVAL OF ASPHALT CONCRETE****1.0 DESCRIPTION**

Removal of asphalt concrete shall consist of the cutting, removal, transporting and disposal of asphalt concrete.

**2.0 REFERENCES****3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

The Contractor shall, where directed by the Engineer, cut, remove, and dispose of asphalt concrete. Waste material from this operation shall be disposed of in an area approved by the Engineer and this area shall be left in an environmentally acceptable condition.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

When the depth of asphalt concrete has been predetermined by coring and is identified in the Special Provisions of the contract, then payment for Removal of Asphalt Concrete will be at the contract unit price per square metre of asphalt concrete removed.

When the depth of asphalt concrete has not been predetermined by coring, then payment for Removal of Asphalt Concrete will be at the contract unit price per square metre for each 200 mm depth of asphalt concrete removed. For example, payment will be made once for depths less than 200 mm, twice for depths from 200 mm to 400 mm, and three times for depths from 400 mm to 600 mm, etc.

The price for the Removal of Asphalt Concrete shall include the supply of all equipment, plant, labour and incidentals necessary to cut, excavate, load, transport and dispose of the asphalt concrete, except materials excavated below the asphalt concrete and paid for as Roadway and Drainage Excavation.

**9.0 WARRANTY**



## Division 4 Pavements

## Section 7 Asphalt Concrete Patching

**SECTION 7 - ASPHALT CONCRETE PATCHING****1.0 DESCRIPTION**

Asphalt concrete patching shall consist of the supply and placement, by hand or machine, of asphalt concrete under the following conditions:

- Repair or replace asphalt concrete within the limits and to the grade of existing asphalt concrete surface (ie. pot holes, cross-cuts for culverts).
- Correct depressions in the existing asphalt concrete surface in "isolated areas". Isolated areas shall be defined as individual sections less than 300 m<sup>2</sup> (ie. sags, areas of wheel rutting).
- On repaving contracts, match (blend) existing pavement outside the normal edge of roadway to the grade of the new asphalt concrete surface. (ie. driveways but not to include intersections with public roads).
- On paving contracts, match new asphalt concrete surface to the existing pavement outside the normal edge of roadway. (ie. driveways).
- On paving or repaving contracts prior to the application of a leveling or surface course, match the grade of the existing asphalt concrete surface where the match strip is less than 3 m in width. (ie. matching the edge of pavement to new curb or to an additional lane or new ramp).

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 4 Section 1, Emulsified Asphalt
- Division 4 Section 4, Asphalt Concrete-Hot Mixed-Hot Placed

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

Prior to placing the hot mix patching material, the areas of the existing pavement shall be tack coated with RS-1 conforming to Division 4 Section 1.

Asphalt Concrete, Type B, Type B-HF, Type C or Type C-HF conforming to Division 4 Section 4, shall be used for Asphalt Concrete Patching. The Contractor shall place Asphalt Concrete Patching by machine, wherever possible, at the discretion of the Engineer to ensure a smooth, uniform surface after compaction.

**6.0 QUALITY CONTROL/QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

The quantity of Asphalt Concrete Patching for which payment will be made shall be the number of tonnes of asphalt concrete placed and accepted by the Engineer.

**8.0 BASIS OF PAYMENT**

Asphalt Concrete Patching will be paid for at the contract unit price per tonne for the Asphalt Concrete actually incorporated and accepted in the work, which price shall be full compensation for furnishing of all materials (except the furnishing of the asphalt cement unless otherwise specified in the Special Provisions), heating, handling, transporting, mixing, placing, and rolling of all materials, the supplying of all equipment, plant, labour, and incidentals necessary to complete the work.

The Contractor shall, at his own expense, provide, install and maintain such approved scales and all suitable facilities as may be required to enable the Engineer to determine accurately the mass of Asphalt Concrete loaded in each truck.

**9.0 WARRANTY**



## Division 4 Pavements

## Section 8 Asphalt Concrete Paving of Bridge Decks

**SECTION 8 - ASPHALT CONCRETE PAVING OF BRIDGE DECKS****1.0 DESCRIPTION**

Work under this item shall consist of the application of asphalt concrete on the bridge deck following the tack coating of the protection boards as specified in Division 5 Section 9 of these specifications.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 5 Section 9, Waterproofing Concrete Bridge Decks
- Division 4 Section 4, Asphalt Concrete-Hot Mixed-Hot Placed
- Division 4 Section 2, Asphalt Cement

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

The bridge deck shall be paved with asphalt concrete Type C which shall conform to Division 4 Section 4 of these specifications.

**5.0 CONSTRUCTION METHODS**

The asphalt concrete shall be placed as soon as practicable after waterproofing of the bridge deck. The bridge deck shall be paved with asphalt concrete Type C at a rate of 135 kg/m<sup>2</sup> or as directed by the Engineer. Asphalt concrete shall be applied with an approved mechanical spreader and shall meet the requirements of Division 4 Section 4 of these specifications.

Trucks or pavers shall not start, stop, or turn too quickly on the deck as this is likely to cause a rupture of the waterproofing or misalign the protection boards. The paver shall travel at a maximum speed of 4 m per minute to provide maximum traction.

The trucks shall dump part of their load into the paver and then move up the deck so the paver does not have to push the truck. Any loose asphalt concrete shall be removed from the protection board before paving begins.

Breakdown rolling of the asphalt concrete shall commence, when the mat cools to 105°C, using a steel wheel roller weighing a minimum of 7 t. The steel wheel roller shall make only one pass over the mat, running off the deck to stop and turn. Vibratory rollers are not permitted to be used on bridge decks. A board shall be placed against the expansion joint verticals to prevent damage by the roller. Final rolling shall be performed with a rubber-tired roller, also running off the deck to stop and turn.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

Asphalt concrete paving of bridge decks will be paid for at the Contract unit price per tonne of asphalt mix, which price shall be full compensation for paving of the deck, including all equipment, plant, labour and tools necessary to complete the work. Supply and Transportation of Asphalt Cement shall be paid for in accordance with Division 4 Section 2 of these specifications or as specified elsewhere in the Special Provisions of the Contract.

The Contractor shall, at their expense, provide, install, and maintain such approved scales and all suitable facilities as may be required to enable the Engineer to determine accurately the mass of asphalt concrete loaded in each truck.

**9.0 WARRANTY**





## Division 4 Pavements

## Section 9 Graded Aggregate Seal (Two Courses)

## SECTION 9 - GRADED AGGREGATE SEAL (TWO COURSES)

## 1.0 DESCRIPTION

Graded aggregate seal shall consist of the application of two courses of high-float emulsified asphalt and graded aggregate; spread and compacted on a prepared and primed surface.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 88, Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
- ASTM C 131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- British Standard 812
- Division 4 Section 1, Emulsified Asphalt
- Division 4 Section 5, Liquid Asphalt Primer
- DOT&PW TM-2, Modified Petrographic Analysis

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Primer.** The primer shall be liquid asphalt and conform to the requirements specified in Division 4 Section 5 of these specifications.

**4.2 High-Float Emulsified Asphalt.** The emulsified asphalt shall be HF-150S and conform to the requirements specified in Division 4 Section 1 of these specifications.

**4.3 Aggregates.** The aggregate shall conform to the physical properties listed in Table 4.9.1.

Table 4.9.1 - Physical Properties

| Property                      | Test Method  | Aggregates |
|-------------------------------|--------------|------------|
| Soundness Loss, %<br>Maximum  | ASTM C 88    | 20         |
| LA. Abrasion, %<br>Maximum    | ASTM C 131   | 35         |
| Petrographic<br>Number        | DOT&PW, TM-2 | 150        |
| Flakiness Index, %<br>Maximum | BS812        | 35         |

The initial and final course of aggregate shall conform to the gradations as outlined in Table 4.9.2.

Table 4.9.2 - Gradation

| Sieve Designation | Cumulative Percent Passing |        |
|-------------------|----------------------------|--------|
|                   | Initial                    | Final  |
| 14 000            | 100                        | 100    |
| 10 000            | 0-60                       | 95-100 |
| 5 000             | 0-20                       | 0-20   |
| 2 500             | 0-9                        | 0-9    |
| 80                | 2-4                        | 2-4    |

## 5.0 CONSTRUCTION METHODS

## 5.1 General

**5.1.1 Scheduling.** The Contractor shall notify the Engineer 24 hours in advance of any production increase which would require additional inspectors.

**5.1.2 Traffic Control.** Where traffic must go over the surface before it is fully cured, the Contractor shall control traffic speed by means of directing the traffic in convoys. The Contractor shall provide a pilot vehicle with appropriate signing to ensure that convoys proceed at a low speed.

**5.1.4 Weather Limitations.** The placement of aggregate seal shall be limited to the period from May 25 to September 1. Aggregate seal shall not be constructed when damage to the finished product may occur for any reason.

**5.1.4 Daylight Hours.** Construction shall be carried out during daylight hours only. The emulsified asphalt shall not be applied to the prepared surface when:

- the atmospheric temperature at the construction area is 15°C and falling. (may be applied when the temperature is 10°C and rising)
- the weather is misty or rainy. If rain is forecast for the next day then all equipment shall be off the road at least 3 hrs before end of daylight hours.

**5.2 Equipment.** The Contractor shall supply all tools, machinery and equipment required in the execution of all phases of the work.

**5.2.1 Pressure Distributor.** An approved pressure distributor used for applying emulsified asphalt shall conform to the requirements specified in Division 4 Section 1 of these specifications.

**5.2.2 Mechanical Aggregate Spreader.** The

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approved self-propelled aggregate spreader shall be capable of continuously and uniformly spreading closely regulated quantities of aggregate at the application rates selected. The spreader shall be equipped with a rear-mounted hopper designed so that a loaded truck may supply aggregate to this hopper while being towed by the spreader. The spreader shall be equipped with a front hopper and an approved means of transferring the aggregate to this hopper from the rear.

The front hopper shall be equipped with an oversize reject screen and metering gates. The gates shall adjust the spreading width and be capable of individual adjustment to obtain a uniform flow of aggregate across the spreading width.

These gates shall also be designed to provide simultaneous movement or closure from the operator's position. The flow of aggregate from the metering gates shall be further controlled by a spread roller, the rotation of which shall automatically commence when the metering gates are opened.

**5.2.3 Rollers.** Steel-wheel or rubber coated vibratory rollers shall have rear pneumatic wheels and a mass of at least 7 t. Pneumatic-tired rollers shall be self-propelled and have a minimum ballasted mass of 8 t. A pneumatic-tired roller shall be used.

**5.2.4 Mechanical Broom.** The mechanical broom shall be of an approved type of power broom suitable for pavement use.

**5.3 Construction Sequence.** The graded aggregate seal shall be applied in the sequence noted herein.

**5.3.1 Priming.** All priming operations shall be performed in accordance with Division 4 Section 5 of these specifications.

**5.3.2 Application of Blotter Sand.** If the prime does not penetrate the base or is subject to pickup by traffic, a crusher dust or fine sand shall be applied at the designated rate, approximately 8 kg/m<sup>2</sup>. The aggregate shall be uniformly applied by means of the approved spreader. The Contractor shall re-treat any areas not completed to the satisfaction of the Engineer.

**5.3.3 Curing.** The newly primed surface shall be allowed to cure for a period of 60 hours, or as directed by the Engineer.

**5.3.4 Preparation for Seal.** Immediately before applying the initial course, the primed surface shall be swept clean of all loose sand, dirt or other debris, pot holes repaired or compacted by steel wheeled roller to the satisfaction of the Engineer. Brooming shall be carried out with approved rotary power brooms or hand brooms.

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**5.3.5 High-Float Emulsified Asphalt - Initial Course.** After the primed surface has been swept or compacted, the emulsified asphalt shall be uniformly sprayed by the distributor at a temperature between 60°C and 80°C. It shall be applied at the design rate, approximately 1.5 - 2.0 L/m<sup>2</sup>. During the application of the emulsified asphalt, the distributor shall not exceed a forward speed of 100 m/min.

**5.3.6 Aggregate Initial Course.** The aggregate shall be uniformly applied by the spreader at the design rate, of approximately 16-18 kg/m<sup>2</sup>, immediately after the emulsified asphalt has been sprayed. The distance between the spreader and the distributor shall not exceed 30 m at any time.

**5.3.7 Rolling - Initial Course.** Immediately after the application of the aggregate, rolling shall commence with a pneumatic-tired roller so that the entire rolling operation is completed within 300 m of the spreader. There shall be no delays in rolling the aggregate. The entire treated areas shall receive at least two passes from the pneumatic-tired roller and one from the steel-wheel vibratory roller or rubber coated vibratory drum roller. The speed of the roller shall not exceed 10 km/h. When the rolling train cannot keep within 300 m of the spreader, additional rollers shall be added or the spreader and the distributor shall stop and wait for the rollers. Rolling shall not be carried out after the emulsified asphalt has broken.

**5.3.8 Brooming - Initial Course.** Any loose aggregate shall be removed by power brooming after curing for 60 hours or as otherwise directed by the Engineer.

**5.3.9 Emulsified Asphalt - Final Course.** Immediately after brooming the initial course it shall be uniformly sprayed with an emulsified asphalt at the design rate, approximately 1.5 - 1.9 L/m<sup>2</sup> and as specified in section 5.3.5.

**5.3.10 Aggregate Final Course.** The aggregate shall be applied at the design rate, approximately 14 - 16 kg/m<sup>2</sup> and as specified in section 5.3.6, immediately following the application of the emulsified asphalt. All of the initial course shall be covered with the final course and shall be completed at least two hours before sunset.

**5.3.11 Rolling - Final Course.** Rolling of the final course shall be as specified in section 5.3.7.

**5.3.12 Brooming - Final Course.** Brooming shall be done as specified in section 5.3.8.

**5.3.13 Blotter Sand.** A crusher dust or fine sand shall be made available for use as a blotting agent should the seal be affected by a sudden rainstorm.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

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Testing of aggregates will be done at either the production site or stockpile site. If test samples taken from the stockpile fail requirements as per Subsection 4.3 then the entire stockpile will be condemned.

**7.0 METHOD OF MEASUREMENT**

**7.1 Primer.** The volume of liquid asphalt shall be calculated at a temperature of 15°C.

**7.2 Emulsified Asphalt.** The volume of emulsified asphalt shall be calculated at a temperature of 15°C.

**8.0 Basis of Payment**

**8.1 Primer.** The liquid asphalt will be paid for at the contract unit price for primer per litre in place which shall be full compensation for the material supply and work required as specified in Division 4 Section 5 of these specifications.

**8.2 Emulsified Asphalt.** The emulsified asphalt will be paid for at the contract unit price for emulsified asphalt per litre or kilolitre in place which shall be full compensation for the material supply and work required as specified in Division 4 Section 1 of these specifications.

No compensation other than the contract price, shall be made for variations in the rates of application or for the retreatment of any areas, as required by the Engineer.

**8.3 Application of Stockpile-Supplied Aggregate.** Aggregate payment at the contract price for application of stockpile-supplied aggregate shall be full compensation for all labour, materials, equipment and any other expenses for handling the aggregate, providing scales, if required, all haulage of the aggregate from the stockpiles to where the aggregate is to be spread, spreading the aggregate, rolling, power brooming; providing and using the lead vehicle for traffic control; and cleaning up the stockpile site, as may be required; and together with all other operations

**Section 9 Graded Aggregate Seal (Two Courses)**

necessary to complete the work, in accordance with this specification and for which payment is not otherwise provided. No compensation, other than the contract price shall be made for variations in the rate of application or for the retreatment of any areas, as required by the Engineer.

**8.4 Supply and Application of Graded Aggregate Seal.** Payment at the contract price for supply and application of aggregate shall be compensation-in-full for all labour, materials, and equipment used and for any other expenses for providing a pit or quarry; obtaining environmental approval; clearing, grubbing and stripping the pit or quarry; processing pit or quarry material to the required gradation and physical requirements; washing the aggregate; providing and maintaining a field laboratory; paying any royalties on the materials; constructing and maintaining an access road to the source of material; providing all haulage of the aggregate from the source to where the aggregate is to be spread; spreading the aggregate; rolling; power brooming; providing and using the lead vehicle for traffic control; and cleaning up and providing such other restoration to the pit or quarry and the stockpile site as may be required; and together with all other operations necessary to complete the work in accordance with this specification and for which payment is not otherwise provided. No compensation, other than the contract price shall be made for variations in the rate of application or for the retreatment of any areas, as required by the Engineer.

**8.5 Supply and Application of Blotter Aggregate.** Payment at the contract unit bid price for the supply and application of blotter aggregate shall be full compensation for supplying, weighing, transporting and spreading the aggregate and shall include all equipment, plant, labour and incidentals necessary to complete the work as directed by the Engineer.

**9.0 WARRANTY**





## Division 4 Pavements

## Section 10 Graded Aggregate Seal (One Course)

**SECTION 10 - GRADED AGGREGATE SEAL (ONE COURSE)****1.0 DESCRIPTION**

Graded aggregate seal shall consist of the application of one course of high-float emulsified asphalt and graded aggregate spread and compacted on a prepared surface.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 88, Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
- ASTM C 131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- British Standard 812, Flakiness Index
- Division 4 Section 1, Emulsified Asphalt
- DOT&PW TM-2, Modified Petrographic Analysis

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

The Contractor shall notify the Engineer 24 hours in advance of any production increase which would require additional inspectors.

**4.0 MATERIALS**

**4.1 High Float Emulsified Asphalt.** The emulsified asphalt shall be HF-150S and conform to the requirements specified in Division 4 Section 1 of these specifications.

**4.2 Aggregates.** The aggregate shall conform to the physical properties listed in Table 4.10.1.

Table 4.10.1 - Physical Properties

| Property                      | Test Method  | Aggregates |
|-------------------------------|--------------|------------|
| Soundness Loss, %<br>Maximum  | ASTM C 88    | 20         |
| LA, Abrasion, %<br>Maximum    | ASTM C 131   | 35         |
| Petrographic<br>Number        | DOT&PW, TM-2 | 150        |
| Flakiness Index, %<br>Maximum | BS812        | 35         |

The aggregate shall conform to the gradation as outlined in Table 4.10.2.

Table 4.10.2 - Gradation

| Sieve Designation | Cumulative Percent<br>Passing |
|-------------------|-------------------------------|
| 14 000            | 100                           |
| 10 000            | 95 - 100                      |
| 5 000             | 0 - 20                        |
| 2 500             | 0 - 9                         |
| 80                | 2 - 4                         |

**5.0 CONSTRUCTION METHODS****5.1 General**

**5.1.1 Traffic Control.** Where traffic must go over the surface before it is fully cured, the Contractor shall control traffic speed by means of directing the traffic in convoys. The Contractor shall provide a pilot vehicle with appropriate signing to ensure that convoys proceed at a low speed.

**5.1.2 Weather Limitations.** The placement of aggregate seal shall be limited to the period from May 25 to September 1. Aggregate seal shall not be constructed when damage to the finished product may occur for any reason.

**Division 4 Pavements**

**5.1.3 Daylight Hours.** Construction shall be carried out during daylight hours only. The emulsified asphalt shall not be applied to the prepared surface when:

- the atmospheric temperature at the construction area is 15°C and falling. (may be applied when the temperature is 10°C and rising)
- the weather is misty or rainy. If rain is forecast for the next day then all equipment shall be off the road at least 3 hrs before end of daylight hours.

**5.2 Equipment.** The Contractor shall supply all tools, machinery and equipment required in the execution of all phases of the work.

**5.2.1 Pressure Distributor.** An approved pressure distributor used for applying emulsified asphalt shall conform to the requirements specified in Division 4 Section 1 of these specifications.

**5.2.2 Mechanical Aggregate Spreader.** The approved self-propelled aggregate spreader shall be capable of continuously and uniformly spreading closely regulated quantities of aggregate at the application rates selected. The spreader shall be equipped with a rear-mounted hopper designed so that a loaded truck may supply aggregate to this hopper, while being towed by the spreader. The spreader shall be equipped with a front hopper and an approved means of transferring the aggregate to this hopper from the rear.

The front hopper shall be equipped with an oversize reject screen and metering gates. The gates shall adjust the spreading width and be capable of individual adjustment to obtain a uniform flow of aggregate across the spreading width.

These gates shall also be designed to provide simultaneous movement or closure from the operator's position. The flow of aggregate from the metering gates shall be further controlled by a spread roller, the rotation of which shall automatically commence when the metering gates are opened.

**5.2.3 Rollers.** Steel-wheel or rubber coated vibratory rollers shall have rear pneumatic wheels and a mass of at least 7 t. Pneumatic-tired rollers shall be self-propelled and have a minimum ballasted mass of 8 t. A pneumatic-tired roller shall be used.

**5.2.4 Mechanical Broom.** The mechanical broom shall be of an approved type of power broom suitable

**Section 10 Graded Aggregate Seal (One Course)**

for pavement use.

**5.3 Construction Sequence.** The work shall be done in the sequence noted herein:

**5.3.1 Sweeping.** Immediately before applying the graded aggregate seal, the road surface shall be swept clean of all loose sand, dirt or other debris or compacted by steel wheeled roller to the satisfaction of the Engineer. Brooming shall be carried out with approved rotary power brooms or hand brooms.

**5.3.2 High-Float Emulsified Asphalt.** After the surface has been swept, the emulsified asphalt shall be uniformly sprayed by the distributor at a temperature between 60°C and 80°C. It shall be applied at the design rate, approximately 1.5 - 2.0 L/m<sup>2</sup>. During the application of the emulsified asphalt, the distributor shall not exceed a forward speed of 100 m/min.

**5.3.3 Graded Aggregate.** The aggregate shall be uniformly applied by the spreader at the design rate, approximately 16 - 18 kg/m<sup>2</sup>, immediately after the emulsified asphalt has been sprayed. The distance between the spreader and the distributor shall not exceed 30 m at any time.

**5.3.4 Rolling.** Immediately after the application of the aggregate, rolling shall commence with a pneumatic-tired roller so that the entire rolling operation is completed within 300 m of the spreader. There shall be no delays in rolling the aggregate. The entire treated areas shall receive at least two passes from the pneumatic-tired roller and one from the steel-wheel vibratory roller or rubber coated vibrating drum roller. The speed of the roller shall not exceed 10 km/h. When the rolling train cannot keep within 300 m of the spreader, additional rollers shall be added or the spreader and the distributor shall stop and wait for the rollers. Rolling shall not be carried out after the emulsified asphalt has broken.

**5.3.5 Brooming.** Any loose aggregate shall be removed by power brooming after curing for 60 hours or as otherwise directed by the Engineer.

**5.3.6 Blotter Sand.** A crusher dust or fine sand shall be made available for use as a blotting agent should the seal be affected by a sudden rainstorm.

**6.0 QUALITY CONTROL/QUALITY ASSURANCE**

Testing of aggregates will be done at either the

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production or stockpile site. If test samples taken from the stockpile fail requirements as per section 4.2 then the entire stockpile will be condemned.

**7.0 METHOD OF MEASUREMENT**

**7.1 Emulsified Asphalt.** The volume of emulsified asphalt shall be calculated at a temperature of 15 C.

**8.0 BASIS OF PAYMENT**

**8.1 Emulsified Asphalt.** Emulsified asphalt will be paid for at the contract unit bid price per litre or kilolitre in place which price shall be full compensation for the conditions laid down in Division 4 Section 1 of these specifications.

**8.2 Application of Stockpile-Supplied Aggregate.** Aggregate payment at the contract price for application of stockpile-supplied aggregate shall be full compensation for all labour, materials, equipment, and any other expenses for handling the aggregate, providing scales, if required, all haulage of the aggregate from the stockpiles to where the aggregate is to be spread, spreading the aggregate, rolling, power brooming, providing and using the pilot vehicle for traffic control and cleaning up the stockpile site, as may be required, and together with all other operations necessary to complete the work, in accordance with this specification and for which payment is not otherwise provided.

**Section 10 Graded Aggregate Seal (One Course)**

No compensation other than the contract price, will be made for variations in the rate of application or for the retreatment of any area, as required by the Engineer.

**8.3 Supply and Application of Graded Aggregate Seal.** Payment at the contract price for supply and application of aggregate shall be full compensation for all labour, materials and equipment used and for any other expenses for providing a pit or quarry, obtaining environmental approval, clearing, grubbing and stripping the pit or quarry, processing pit or quarry material to the required gradation and physical requirements, washing the aggregate, providing and maintaining a field laboratory, paying any royalties on the materials, constructing and maintaining an access road to the source of material, providing all haulage of the aggregate from the source to where the aggregate is to be spread, spreading the aggregate, rolling, power brooming, providing and using the pilot vehicle for traffic control, cleaning up and providing such other restoration to the pit or quarry and the stockpile site as may be required and together with all other operations necessary to complete the work in accordance with this specification and for which payment is not otherwise provided.

No compensation other than the contract price, will be made for variations in the rate of application or for the retreatment of any area, as required by the Engineer.

**9.0 WARRANTY**



## Division 4 Pavements

## Section 11 Crack Filling and Crack Sealing (EPWS)

**SECTION 11 - CRACK FILLING AND CRACK SEALING - (EPWS)****1.0 DESCRIPTION**

The work shall consist of either filling or sealing of existing cracks in asphalt pavement including asphalt-covered bridge decks, as directed by the Engineer, with an approved rubberized, joint sealing compound. In general, the work shall be carried out between June 1 and September 30 unless otherwise directed by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 3405, Specification for Joint Sealers, Hot-Poured, for Concrete and Asphalt Pavements
- Division 1 Section 3, Subsection 6, Agreement
- Division 1 Section 4 Subsection 25, General Provisions
- DOT&PW Traffic Control Manual
- Federal Specification SS-S-164

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

A copy of the Manufacturer's product specification compliance, for each lot of joint sealing compound to be used in this contract shall be provided to the Engineer prior to the commencement of work.

**4.0 MATERIALS**

**4.1 Sealing Compound.** The joint sealing compound shall be a hot-poured, rubberized, asphalt compound certified by the Manufacturer to conform to the requirements of ASTM D 3405 and Federal Specification SS-S-164.

Approved sealing compounds are:

- Hydrotech Hot Poured 6165
- Bakor 590-13A
- W.R. Meadows A N0164R
- Crafcro Overflex M.S.
- Bemac Beram 195

**4.2 Dusting Material.** The material used to dust the sealed crack shall be ordinary Portland cement or agricultural limestone.

**5.0 CONSTRUCTION METHODS**

**5.1 Equipment.** The Contractor shall supply all tools,

machinery and equipment required in the execution of all phases of the work.

**5.1.1 Routing and Cutting Equipment.** The routing and cutting equipment shall be of a type which can expeditiously cut and form joints to the sizes specified. The equipment shall be sufficiently flexible and portable to follow random cracking in the pavement. The equipment shall have cutter tools which are capable of cutting grooves 40 mm wide by 10 mm deep leaving the sides of the joint absolutely clean, smooth and ready for sealing.

**5.1.2 Melter.** A portable melting kettle shall be provided having rubber tires and equipped with an effective, mechanically operated agitator. The kettle shall be of the double boiler, indirect heating type, using a flash point oil (315°C minimum) as a heat transfer medium. The kettle shall be equipped with thermometric controls which automatically control the product temperature and the heat transfer oil.

**5.1.3 Compressor.** The compressor shall be 75 C.F.M. capacity, or more, to ensure an adequate supply of air to effectively clean the joints.

**5.1.4 Hot Compressed Air Equipment.** A hot compressed air lance shall be used to clean, dry and pre-heat cracks prior to applying sealant. The air lance shall consist of a compressor propane system providing a high temperature, high velocity blast of air. (See 5.2.1).

Equipment shall be safety approved.

**5.2 Crack Filling Procedure.**

**5.2.1 Cleaning the Cracks.** A hot compressed air lance shall be coured along the pavement crack at a slow walk to blow out debris and to heat and dry the crack. All debris shall be removed from the pavement surface immediately. The crack shall be heated until the asphalt concrete turns black. The H.C.A. lance shall be supplied by a 45 kg. L.P. propane bottle and a 75 C.F.M. Compressor.

**5.2.2 Melting of the Compound.** Care shall be exercised in stripping and removing the joint sealing compound from the original Manufacturer's packages to ensure that no foreign material enters the melting unit. The material shall be melted only in equipment fully meeting the requirements of these specifications. Constant mechanical agitation shall be employed to



**Division 4 Pavements****Section 11 Crack Filling and Crack Sealing (EPWS)**

ensure maximum heating and pouring temperatures as established by the Manufacturer. Overheated, burned or under heated material shall not be used and shall be removed from the site at the Contractor's expense.

**5.2.3 Placing Compound.** All uncut cracks shall be carefully inspected prior to sealing to ensure that they are thoroughly dry, clean and free from dust and debris. The liquid sealing compound shall be poured within two minutes after the H.C.A. lance has coursed the uncut crack and while it is still hot. Immediately after the crack has been filled it shall be struck off flush with the adjacent pavement surface with a squeegee or other approved device. Particular care shall be taken to ensure that material is not spilled or poured over the adjacent pavement.

**5.2.4 Dusting.** As the sealing compound begins to cool, the surface of the compound shall be sprinkled with ordinary Portland cement or agricultural lime sufficient to cover the surface.

**5.2.5 Crack Sealing Procedure - Routing Cracks.** All random cracks that are less than 19 mm in width but greater than 3 mm in width shall be routed out to a width of no more than 40 mm. The depth of cut will be 10 mm.

**5.2.6 Cleaning the Cracks - Routing.** A hot compressed air lance shall be coursed along the pavement crack at a slow walk to blow out debris and to heat and dry the crack. All debris shall be removed from the pavement surface immediately. The crack or rout shall be heated until the asphalt concrete turns black. The H.C.A. lance will be supplied by a 45 kg L.P. propane bottle and a 75 C.F.M. compressor.

**5.2.7 Melting of the Compound - Routing.** Care shall be exercised in stripping and removing the joint sealing compound from the original Manufacturer's packages to ensure that no foreign material enters the melting unit. The material shall be melted only in equipment fully meeting the requirements of these specifications. Constant mechanical agitation shall be employed to ensure maximum heating and pouring temperatures as established by the Manufacturer. Overheated, burned or under heated material may not be used and shall be removed from the site at the Contractor's expense.

**5.2.8 Placing Compound - Routing.** All cracks shall be carefully inspected prior to sealing to ensure that they are thoroughly dry, clean and free from dust and debris. The liquid sealing compound shall be poured within two minutes after the H.C.A. lance has coursed the crack and while it is still hot. The surface of the

sealing material shall be flush with the adjacent pavement surface on completion. Particular care shall be taken to ensure that the material is not spilled or poured over the adjacent pavement.

**5.2.9 Dusting - Routing.** As the sealing compound begins to cool the surface of the compound shall be sprinkled with ordinary Portland cement or agricultural lime sufficient to cover the surface.

**5.2.10 Daily Output - Routing.** All cracks routed shall be sealed on the same day as routed. The Contractor shall have the capability of routing and sealing a minimum of 2500 m/full day.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

A sample of the sealing compound may be tested and approved by the Department or its representative before the actual work is started in the field. Samples may also be taken from each lot of material delivered to the site.

**7.0 METHOD OF MEASUREMENT**

Measurement for payment for Crack Filling or Crack Sealing shall be based on the accepted filled or sealed cracks measured in metres using a metering wheel following line generally representing the length of the crack. Measurement shall be carried out by Department personnel.

**8.0 BASIS OF PAYMENT**

Crack Filling/Crack Sealing will be paid for at the contract unit price per metre, accepted in place, which price shall be full compensation for the supply of all labour, equipment, material and incidentals necessary to complete the work, including the control and accommodation of traffic in accordance with the DOT&PW "Traffic Control Manual".

**9.0 WARRANTY**

Upon completion of the Crack Filling and Crack Sealing and visual acceptance of the work in accordance with these specifications, a one year maintenance period will begin. During this period any failure in the Crack Filling and Crack Sealing including but not limited to areas of debonding or complete loss of the sealant shall be repaired or reconstructed at the Contractor's expense to the satisfaction of the Engineer. All material, haul, traffic control and related work required for repair or reconstruction of unacceptable areas shall be paid by the Contractor.

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**9.1 Final Acceptance.** The Department or its representative, and the Contractor will meet and inspect the crack filling and crack sealing one year after the completion of the work. All areas that have failed shall be repaired at the Contractor's expense at no cost to the Department. If the Contractor and the Department do not agree on what areas are failed, the Department's decision shall be final.

The final acceptance of the original Crack Filling and Crack Sealing by the Department shall relieve the Contractor from all maintenance responsibility with respect to the original Crack Filling and Crack Sealing, however, the Contractor shall be held responsible to maintain repaired areas for a period of 12 months after repairs are made.

**9.2 Liability.** During the period of construction and the one year maintenance period the Contractor shall be responsible for processing any and all claims for property damage and/or bodily injury caused by the failure of the Crack Filling and Crack Sealing including, but not limited to, motor vehicle or pedestrians. The Contractor shall be responsible for the payment of all property damage and bodily injury claims and agrees to

save and hold harmless the Department from all such claims as set out in Division 1 Section 4 Subsection 25 of these specifications. Claims not handled by the Contractor or his representative efficiently or expediently will be settled by the Department and the costs recovered from the Contractor.

**9.3 Security Deposit.** Notwithstanding anything to the contrary, as stated in Division 1 Section 3 Subsection 6 of these specifications, the security deposit for this contract will be held and retained by the Minister until the maintenance period has expired. The security deposit will be held to ensure that sufficient funds will be available to the Department in the event of non-performance by the Contractor. The Contractor is responsible for all costs including the materials and haul and for the repair of all failures and damages resulting from negligence or faulty workmanship by the Contractor that adversely affects the integrity of the Crack Filling and Crack Sealing which occurs, and is evident prior to, the expiration of the one year maintenance period. The amount of security deposit shall be approximately 20% of the estimated value of the tender.



## Division 4 Pavements

## Section 12 Seal Coat (EPWS)

## SECTION 12 - SEAL COAT - (EPWS)

## 1.0 DESCRIPTION

The Contractor shall apply a seal coat surface treatment consisting of a single application of polymer modified asphalt emulsion and aggregate, and warrant the work for one year.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 127, Test Method for Specific Gravity and absorption of Coarse Aggregate
- ASTM C 131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM D 5, Test Method for Penetration of Bituminous Materials
- ASTM D 244, Test Methods for Emulsified Asphalts
- ASTM D 2042, Test Method for Solubility of Asphalt Materials in Trichloroethylene
- ASTM D 2415, Test Method for Ash in Coal Tar and Pitch
- British Standard 812, Flakiness Index
- Division 1 Section 3 Subsection 6, Agreement
- Division 4 Section 11, Crack Filling and Crack Sealing
- DOT&PW TM-2, Modified Petrographic Analysis
- DOT&PW Traffic Control Manual

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Seal Coat Design.** The Contractor shall be responsible for all aspects of the mix design.

For information purposes only a copy of the design shall be submitted to the Engineer two weeks before the work proceeds. Any changes in the design shall be forwarded to the Engineer within one working day.

## 4.0 MATERIALS

**4.1 Supply of Materials.** The Contractor shall supply all materials for the execution of the work.

**4.2 Aggregate.** The cover aggregate shall be produced from a quarried source and shall be washed and free from thin or elongated particles, clay, wood fragments or other deleterious matter.

The seal coat aggregate shall comply with the following gradation and physical requirements:

Table 4.12.1 - Gradation of Seal Coat Aggregate

| Sieve Designation | Cumulative Percent Passing |
|-------------------|----------------------------|
| 14 000            | 100                        |
| 10 000            | 96 - 100                   |
| 6 300             | 0 - 43                     |
| 5 000             | 0 - 10                     |
| 2 500             | 0 - 3                      |
| 1 250             | 0 - 0.5                    |
| 80                | 0 - 0.3                    |

Table 4.12.2 - Physical Properties of Seal Coat Aggregate

| Property                   | Test Method | Aggregate |
|----------------------------|-------------|-----------|
| Absorption, %<br>Maximum   | ASTM C127   | 1.75      |
| LA. Abrasion, %<br>Maximum | ASTM C131   | 35        |
| Flakiness Index,<br>%      | BS812       | 35        |
| Petrographic<br>Number     | DOT&PW      | 135       |

**4.3 Asphalt Emulsion.** A polymer modified asphalt emulsion, CRS-2P conforming to the following requirements shall be used:

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## Section 12 Seal Coat (EPWS)

Table 4.12.3 - Physical Properties CRS-2P

| Requirements                                                     | Min      | Max  |
|------------------------------------------------------------------|----------|------|
| Viscosity <sup>(1)</sup> , SFs                                   | 75       | 400  |
| Residue <sup>(2)</sup> , % by Mass                               | 65       | --   |
| Settlement <sup>(3)</sup> , 24 hours, %                          | --       | 1    |
| Demulsibility <sup>(4)</sup> , %                                 | 40       | --   |
| Oil Portion of Distillate <sup>(5)</sup> , % by Vol. of Emulsion | --       | 3    |
| Sieve Test <sup>(6)</sup> , % by Mass                            | --       | 0.20 |
| Particle Charge <sup>(7)</sup>                                   | Positive |      |
| Tests on Residue                                                 |          |      |
| Penetration <sup>(8)</sup> , 0.1 mm                              | 100      | 250  |
| Solubility <sup>(9)</sup> , %                                    | 97.5     | --   |
| Ash Content <sup>(10)</sup> , % by Mass of Residue               | --       | 1.0  |
| Elastic Recovery, @ 10°C, %                                      | 55       | --   |

<sup>(1)</sup> ASTM D 244, tested at 50°C using Furol orifice.

<sup>(2)</sup> ASTM D 244, residue from distillation to 204.4°C.

<sup>(3)</sup> ASTM D 244

ASTM D 244, using 35 mL Diocyl Sodium Sulfosuccinate Solution (0.8%).

<sup>(5)</sup> ASTM D 244

<sup>(6)</sup> ASTM D 244, % by mass retained on 1000 sieve.

<sup>(7)</sup> ASTM D 244, tested using a 12V direct current and expressed as negative (anionic) or positive (cationic) charge.

<sup>(8)</sup> ASTM D 244, D5 at 25°C and 100 g in 5s.

<sup>(9)</sup> ASTM D 244, D2402 using trichlorethylene and expressed as % by mass.

<sup>(10)</sup> ASTM D 2415, the ash content shall be determined when the manufacturer indicates that the polymer additive is not soluble in trichlorethylene.

## 5.0 CONSTRUCTION METHODS

## 5.1 General

5.1.1 Traffic Control. Traffic control shall be in accordance with the Department "Traffic Control

Manual" for the class of road to be seal coated.

5.1.2 Weather Limitations. The Department reserves the right to direct the Contractor to discontinue seal coating operations when, in the opinion of the Engineer or representative, weather creates conditions dangerous to the travelling public.

5.1.3 Limits of Work. The seal coat shall be constructed to a width as directed by the Engineer or as specified in the Special Provisions.

5.1.4 Limitations on Advancement. The maximum distance seal coating of a travel lane may proceed ahead of seal coating of an adjacent travel lane shall be 3 km on undivided highways and 4 km on divided highways.

5.2 Equipment. The Contractor shall supply all tools, machinery and equipment in satisfactory working condition at all times to ensure a high quality product.

The Department reserves the right to order the discontinuance of use of any equipment or method of operation which in the opinion of the Engineer, or representative, endangers the travelling public.

## 5.3 Construction Sequence.

5.3.1 Surface Preparation. Any asphalt concrete patching required shall be completed at least three weeks prior to commencement of the seal coat operation. Cracks shall be sealed or filled in accordance Division 4 Section 11.

5.3.2 Application of Polymer Modified Asphalt Emulsion. The Contractor shall apply the polymer modified asphalt emulsion to the existing surface at the application rate determined by the Contractor.

The Contractor shall take necessary action to ensure that structures, curbs, guardrail and other such surfaces shall not be coated with polymer modified asphalt emulsion. The Contractor shall remove any asphalt emulsion over spray caused by his operation. Any areas that are to receive an application of polymer modified asphalt emulsion that are not sprayed shall be corrected. Asphalt emulsion shall not be spilled, sprayed or tracked on completed sections of seal coat. Bridge expansion joints shall be protected with building paper.

5.3.3 Application of Aggregate. The Contractor shall apply the aggregate to the surface at the applications rate determined by the Contractor.



**Division 4 Pavements****Section 12 Seal Coat (EPWS)**

**5.3.4 Brooming.** The Contractor shall broom all treated areas as often as necessary following completion of the work until final acceptance as specified in Subsection 9.2 is obtained to reduce the possibility of flying seal coat aggregate.

The Department reserves the right to order the Contractor to broom the seal coated surface should persons or property be subject to unsafe conditions or damage as a result of loose seal coat aggregate.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Quality Control.** Quality control testing shall be the responsibility of the Contractor throughout every stage of the work including the production of the aggregates and polymer modified asphalt emulsion to the design and placement of the final product.

The Contractor shall provide the Engineer with a copy of all quality control test results within 24 hours of testing.

**6.2 Quality Assurance.** During the progress of the work, quality assurance testing may be conducted by the Department or its representative to ensure compliance with the specifications.

Results of the quality assurance testing will be available to the Contractor within 24 hours.

Quality assurance testing performed by the Department or its representative will not be considered to be quality control testing. Sampling and testing necessary to perform quality assurance monitoring will be at no cost to the Contractor.

**7.0 METHOD OF MEASUREMENT**

The quantity for payment shall be the area of accepted work as measured along the lineal grade of the roadway.

**8.0 BASIS OF PAYMENT**

The contract bid price per square meter of accepted seal coat shall be full compensation for all equipment, labour, tools, designs, quality control, traffic control and incidentals necessary to complete the work in accordance with these specifications.

The contract bid price shall also include any other work such as additional signing, sweeping, etc., required to protect the travelling public until the final maintenance period has expired and the work receives final

acceptance by the Department.

**9.0 WARRANTY**

Opening to traffic does not constitute acceptance of the work and the Contractor shall remain responsible for all claims and the quality of the work until final acceptance of the work by the Department

**9.1 Requirements for Initial Acceptance of the Work.** The completed seal coat will be accepted and a one year maintenance period will begin when the following requirements have been met:

- a minimum of 99% coverage has been obtained with no single bare area greater than 0.01 m<sup>2</sup> in any one square metre; and
- there is no streaking or raveling; and
- the surface of the seal has a uniform, even texture; and
- no over-rich or bleeding areas are evident; and
- no deficiencies in workmanship exist.

Seal coat that does not meet the foregoing requirements shall be repaired using compatible materials. All repair or reconstruction cost including, but not limited to, materials, hauling, placing, traffic control, etc., shall be at the Contractor's expense.

Initial acceptance of the work will be given to the Contractor by the Engineer in writing indicating the date of acceptance.

**9.2 Final Acceptance.** The Department or its representative, and the Contractor shall meet and inspect the seal coat one year after the completion of the work. Poor stone retention, and flushing or bleeding of the surface shall be recognized as failure.

More specifically, the Department recognizes failure has occurred if one of the following conditions exist:

- less than 97% seal per 100 m section of roadway remains; or
- any individual bare area greater than 0.06 m<sup>2</sup> exists; or
- greater than 5 m total length of over-rich or bleeding, area(s) per lane per 100 m section of roadway exists.

All areas that have failed shall be repaired at the Contractor's expense. Any engineering expenses incurred by the Department for these repairs shall be withheld from funds otherwise payable to the Contractor.

Based on the aforementioned criteria to determine failure, if the Contractor and the Department do not

**Division 4 Pavements****Section 12 Seal Coat (EPWS)**

agree on what areas are failed, the Department's decision shall be final.

Final acceptance of the original seal coat by the Department shall relieve the Contractor from all maintenance responsibilities, however, the Contractor shall be held responsible to maintain repaired areas for a period of 12 months after repairs are made.

**9.3 Liability.** During the one year maintenance period the Contractor shall be responsible for processing any and all claims for property damage and/or bodily injury caused by flying aggregate from the work site including, but not limited to, motor vehicle or pedestrians. The Contractor shall be responsible for the payment of all property damage and bodily injury claims and shall indemnify and save harmless the Minister from and against all claims, demands, loss, costs, damages, actions, suits or other proceedings by whomsoever made, brought or prosecuted in any manner based upon, occasioned by or attributable to flying aggregate from the work site or otherwise from the performance of this agreement by the Contractor or his servants or

agents. Any such third party claim which is not finalized in a prompt and efficient manner may be finalized by the Department and where this is done the Contractor shall reimburse the Department for any reasonable and necessary payment made to finalize the claim.

**9.4 Security Deposit.** Notwithstanding anything to the contrary, and as stated in Division 1 Section 3 Subsection 6 of these specifications, the security deposit for this contract shall be held and retained by the Minister until the one-year maintenance period has expired. The security deposit shall be held to ensure that sufficient funds will be available to the Department in the event of non-performance by the Contractor. The Contractor shall be responsible for all costs including the materials and haul and for the repair of all failures, traffic control and damages resulting from negligence or faulty workmanship by the Contractor that adversely affects the integrity of the seal coat surface which occurs and is evident prior to the expiration of the one year maintenance period. The amount of security deposit shall be approximately 20% of the estimated value of the tender.

## Division 4 Pavements

## Section 13 Reclaimed Asphalt Concrete

## SECTION 13 - RECLAIMED ASPHALT CONCRETE

## 1.0 DESCRIPTION

Reclaimed Asphalt Concrete (RAC) to be used on a contract will be noted in the Special Provisions.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 4 Section 1, Emulsified Asphalt

## 3.0 SUBMISSION AND DESIGN REQUIREMENTS

Application rates are as stated in the specifications but may be adjusted by the Department based on field experience.

## 4.0 MATERIALS

**4.1 Slow Setting Emulsified Asphalt.** The emulsified asphalt shall be SS-1 and conform to the conditions laid down in Division 4 Section 1 of these specifications.

**4.2 RAC Material.** All RAC shall be passed through a 50 mm screen when the material is removed from the stockpile and immediately before delivery to the job site. Screening shall remove oversized pieces, crack filler and other undesirable materials.

## 5.0 CONSTRUCTION METHODS

Prior to the placement of gravels and RAC the existing road shall be fine graded. Weak areas that may exist in the road will be determined by the Engineer. The weak area in the road shall be strengthened as directed by the Engineer.

The RAC shall be applied using a Midland Paver, or an approved equivalent, capable of adding a precisely metered amount of emulsified asphalt. The paver shall be calibrated by gate opening and belt speed (l/hr) which shall determine the rate at which the emulsified asphalt metering device shall operate. The emulsified asphalt metering device shall be calibrated by diverting the flow into a tared tank truck or container.

The breakdown rolling shall be done with a steel wheeled roller, or combination steel-rubber tired roller with a mass not less than 7 t. Compaction shall continue until no further consolidation is evident. A

nuclear density gage may be used to determine the maximum density for the given day of placement.

The backrolling shall be done with a pneumatic tired roller, or equivalent with a mass not less than 8 t, one or two days later as requested by the Engineer.

The RAC shall be applied at a thickness of 90 mm unless otherwise directed by the Engineer.

**5.1 Operation Limitations.** Placing of RAC shall not be permitted after September 15th. RAC Paving shall not be constructed when damage to the finished product may occur for any reason.

**5.1.1 Weather Condition.** Placing of RAC shall not be permitted if:

- the atmospheric temperature at the construction site is 10°C and falling;
- the weather is raining or misty.

**5.3 Shouldering Operation.** The shouldering operation shall not be permitted for a minimum of two weeks after placement of the RAC.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

When measuring the square metre area of RAC for payment the maximum width used shall be the width requested prior to paving.

## 8.0 BASIS OF PAYMENT

**8.1 Emulsified Asphalt.** Emulsified Asphalt will be paid for at the contract unit price per litre or kilolitre in place, calculated at a temperature of 15°C, which price shall be full compensation for the conditions laid down in Division 4 Section 1 of these specifications.

**8.2 Reclaimed Asphalt Concrete.** Reclaimed Asphalt Concrete will be paid for at the contract unit bid price per square metre which price shall be full compensation for screening, stockpiling if necessary, transporting from the screening operation to road, placing and compacting the RAC, and shall include all equipment, plant, labour and incidentals necessary to complete the work.

## 9.0 WARRANTY



## Division 4 Pavements

## Section 14 Sand Seal Surface Treatment

**SECTION 14 - SAND SEAL SURFACE TREATMENT****1.0 DESCRIPTION**

Sand Seal surface treatment shall consist of applying a liquid asphalt primer covered by a graded sand to either a prepared aggregate surface or a previously sand sealed surface.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 11, Fine Grading
- Division 2 Section 12, Fine Grading
- Division 3 Section 2, Gravel Type 1, 1S and 2
- Division 4 Section 1, Emulsified Asphalt
- Division 4 Section 5, Liquid Asphalt - Primer

**3.0 SUBMISSION AND DESIGN REQUIREMENTS**

Application rates are stated in the specifications but may be adjusted by the Department based on field experience.

**4.0 MATERIALS**

**4.1 Prime Coat.** The primer shall be a liquid asphalt conforming to the requirements of Division 4 Section 5.

**4.2 Sand.** The aggregate used as a sand cover shall be a clean sand conforming to the following gradation:

Table 4.14.1 - Gradation

| Sieve Designation | Cumulative Percent Passing |
|-------------------|----------------------------|
| 20 000            | 100                        |
| 5 000             | 65 - 95                    |
| 315               | 20 - 70                    |
| 80                | 2 - 12                     |

The total clay content of the sand shall not exceed 1.5%.

The moisture content at the time of application shall not exceed 6%.

**5.0 CONSTRUCTION METHODS**

**5.1 Equipment.** The contractor shall supply all tools, machinery and equipment required in the execution of all phases of the work.

**5.1.1 Pressure Distributor.** The pressure distributor shall conform to Division 4 Section 1. The approved pressure distributor used for applying the prime coat shall be capable of spraying closely regulated quantities in a uniform manner over a width, if required, of not less than 3.5 m.

Tank wagons and trucks used for the transportation or application of prime coat shall be equipped with satisfactory thermometers for measuring the temperature of the material to be applied.

**5.1.2 Sand Spreader.** The approved self-propelled sand spreader shall be capable of applying a continuous uniform quantity of sand at a selected application rate.

The spreader shall be equipped with a rear-mounted hopper designed so that a loaded truck may supply sand to the hopper while being towed by the spreader. The spreader shall also be equipped with a front hopper and an approved means of transferring the aggregate to this hopper from the rear.

Metering gates on the front hopper shall be capable of adjusting the width of spread and obtaining a uniform flow of aggregate across the spread width.

**5.2 New Sand Seal.** The sand seal surface treatment work shall be done in the following sequence:

**5.2.1 Preparation of Road.** The Contractor shall notify the Engineer at least two weeks prior to start of work to allow sufficient time for certain preparatory work to be carried out by maintenance forces. Prior to placing the prime coat, the existing road shall be fine graded and Type 1 Gravel, conforming to Division 3 Section 2 of these specifications, shall be applied at a rate as directed by the Engineer.

Immediately prior to placing the prime, the gravel shall be floated with a grader to provide an open surface to accept the prime.

**5.2.2 Prime.** Over the prepared gravel surface, asphalt prime shall be uniformly sprayed by a distributor as specified in Division 4 Section 1 of these specifications at a rate of approximately 1900 ml/m<sup>2</sup> to 2700 ml/m<sup>2</sup> depending on the penetration into the



**Division 4 Pavements****Section 14 Sand Seal Surface Treatment**

gravel surface. The temperature of the prime shall not be less than 30°C nor more than 45°C. The width of the primed surface shall vary as directed by the Engineer depending on the width of the road.

**5.2.3 Application of Sand Cover.** Following the application of the prime coat, a sand cover shall be uniformly applied with an approved spreader at a rate of approximately 9 kg/m<sup>2</sup> to 11 kg/m<sup>2</sup>.

**5.2.4 Rolling.** Immediately after application of the sand cover, rolling shall commence using a steel wheeled roller. The entire treated area shall receive at least two passes of the roller. The rolling operation shall be completed within 300 m of the spreader. The speed of the roller shall not exceed 10 km/h.

**5.3 Sand Reseal.** The existing previously sand sealed surface will be patched, where necessary, and made ready for resealing by the Department maintenance forces. The Contractor shall notify the Engineer at least two weeks prior to start of work to allow sufficient time for preparatory work to be carried out.

**5.3.1 Prime Coat.** Over the previously sand sealed surface, asphalt prime coat shall be applied uniformly at a rate of approximately 1100 ml/m<sup>2</sup> to 1400 ml/m<sup>2</sup> depending on the amount of deterioration of the existing surface. The temperature of the prime shall be not less than 15°C nor more than 50°C. The width of the primed surface shall be sufficient to cover the previous sand seal unless otherwise directed by the Engineer.

**5.3.2 Application of Sand Cover.** The Sand Cover is the same as detailed in Subsection 5.7.

**5.3.3 Traffic Control.** Traffic shall not be permitted on the primed surface prior to the application of the sand cover. Adequate signing and traffic control persons shall be provided to direct traffic around the work site.

**5.3.4 Weather Limitations.** Sand Seal shall only be applied on a dry surface at minimum air temperature of 7°C. Work shall not be carried out when, in the opinion of the Engineer, high humidity, dampness or the imminence of rain are not conducive to successful results.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

**8.1 Fine Grading.** Fine Grading will be paid for in accordance with Division 2 Section 12 of these specifications.

**8.2 Type 1 Gravel.** Type 1 Gravel will be paid for in accordance with Division 3 Section 2 of these specifications.

**8.3 Prime.** Prime shall be furnished by the Contractor. Payment shall be in accordance with Division 4 Section 5 of these specifications with the exception of the unit of payment which will be the kilolitre and not the litre.

**8.4 Sand Seal and Sand Reseal.** Payment for the supply and application of sand will be at the contract bid price per cubic metre which shall be full compensation for the manufacture, screening, loading, transporting and spreading of the sand and shall include all labour, equipment, plant and incidentals necessary to complete the work.

No compensation, other than the contract bid price shall be made for variations in application rate or for re-treatment of any areas, as required by the Engineer.

**9.0 WARRANTY**

## Division 4 Pavements

## Section 15 Cold Mix for Winter Patching

## SECTION 15 - COLD MIX FOR WINTER PATCHING

## 1.0 DESCRIPTION

Cold mix shall be a plant mixed material composed of crushed aggregate and modified asphalt binders manufactured (dried and mixed through a hot mix plant) and delivered to the Department at various locations by the Supplier.

## 2.0 REFERENCES

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Mix Requirements.** The cold mix shall be capable of maintaining all of its performance features and remain pliable in uncovered stockpiles for a period of one year after delivery.

**3.2 Independent Review.** Prior to product acceptance the supplier shall provide to the Department records of independent testing for every 500 t of production indicating that the cold mix meets the requirements of this specification.

## 4.0 MATERIALS

The cold mix shall possess adequate stripping resistance, workability and cohesion as determined by the following tests:

**4.1 Stripping Resistance.** 50 g of cold mix shall be placed in 400 ml of boiling distilled water in a 600 ml glass beaker. It shall be stirred with a glass rod at one revolution per second for 3 minutes.

The percentage coating retained shall then be visually evaluated. Retained coatings of less than 95% shall constitute failure.

**4.2 Workability.** This test method covers the determination of the workability property of cold patching material (CPM) in cold temperatures (e.g. at -10°C) by blade resistance. The test method TPW-TM7 describing the procedure is available from the Technical Services Library.

A maximum workability index (W.I.) of 2000 Newtons (N) is required.

**4.3 Cohesion.** Two, 1200 g samples of cold mix and two standard Marshall molds shall be cooled to  $4 \pm 1^\circ\text{C}$ . Then place sufficient cooled cold mix material (approximately 800 g) into the cooled standard Marshall molds such that the final compacted height of the samples shall be 63.5 mm high with a diameter of 102 mm. The sample shall be compacted using 5 blows of

a standard Marshall hammer (4.5 kg) to each side, from a drop height of 457 mm. The sample shall then be extruded and a record of the mass of the compacted sample kept. The compacted sample shall then be placed along the bottom edge of a 305 mm diameter sieve with a 25 mm nominal opening size while both the sieve and the sample are standing on end. The cover shall be placed on the sieve while it is still on end. The sieve shall then be rolled with the sample inside back and forth 20 times, taking approximately 1 second for each of the 20 passes. Laying the sieve against the edge of a table for ten seconds, allow time for sample pieces to fall through the sieve openings. Then flip the sieve and lid over so that the sample in the sieve falls onto the lid and weigh the material retained. Determine the average percentage retained by dividing the weight retained by the original weight.

A minimum retention value of 60% is required.

## 5.0 CONSTRUCTION METHODS

**5.1 Placement.** The cold mix shall be placed in potholes (which may or may not be filled with water).

**5.2 Compaction.** The cold mix will normally be compacted by rolling with truck tires, allowing for a crown of between 3.2 mm and 6.4 mm.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Department Testing.** Prior to product acceptance the Department may request the supplier to provide samples of the cold mix to be tested by the Department or its representative.

**6.2 Stockpile Sampling and Testing.** The cold mix may be sampled randomly from stockpile by the Department or its representative. Failure to conform to specification requirements shall result in product rejection.

**6.3 Field Performance.** The cold mix shall not rut or ravel out of potholes for a period of six months after placement. Failure to conform to specification requirements shall result in product rejection.

**6.4 Disposal of Rejected Material.** Rejected material shall be weighed and removed from Department facilities at the Supplier's expense.

**6.5 Replacement of Rejected Material.** All rejected material shall be replaced with material conforming to specification by the supplier and delivered to the Department facilities, all at the suppliers expense.

**Division 4 Pavements****Section 15 Cold Mix For Winter Patching****7.0 METHOD OF MEASUREMENT**

The Contractor shall, at their own expense, provide, install and maintain such approved scales and all suitable facilities as may be required to enable the Engineer to determine accurately the weight of asphalt concrete loaded into each truck.

**8.0 BASIS OF PAYMENT**

Cold mix will be paid for at the contract unit price per tonne which shall be full compensation for the furnishing of all materials (including the asphalt cement) including handling, mixing, weighing and transporting to Department depots of cold mix to meet the

requirements as herein specified.

**9.0 WARRANTY**

**9.1 Security Deposit.** Notwithstanding anything to the contrary, as stated in Division 1 Section 3 Subsection 6 of these specifications, the security deposit for this contract will be held and retained by the Minister for one year after final delivery of the product. The security deposit will be held to ensure that sufficient funds will be available to the Department in the event of non-performance by the Contractor. The amount of security deposit shall be approximately 10% of the estimated value of the tender.

## Division 4 Pavements

## Section 16 Micro-Surfacing

## SECTION 16 - MICRO-SURFACING - (EPWS)

## 1.0 DESCRIPTION

Micro-surfacing shall include both surface and rut fill application unless otherwise specified.

Micro-surfacing shall consist of the maintenance and application of a homogeneous mixture of cationic polymer modified emulsified asphalt, mineral aggregate, mineral filler, water and other additives to the existing pavement surface.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D36, Test Method for Softening Point of Bitumen
- ASTM D244, Test Methods for Emulsified Asphalts
- ASTM D2170, Test Method for Kinematic Viscosity of Asphalts
- ASTM D2397, Specification for Cationic Emulsified Asphalt
- ASTM D2419, Test for Sand Equivalent Value of Soils and Fine Aggregate
- ASTM E303, Method of Measuring Surface Frictional Properties Using British Pendulum Tester
- ISSA TB-100, Wet Track Abrasion Loss
- ISSA TB-109, Excess asphalt by LWT Sand Adhesion
- ISSA TB-113, Mix Time
- ISSA TB-114, Wet Stripping
- ISSA TB-139, Wet Cohesion
- ISSA TB-144, Classification Compatibility
- ISSA TB-147A, Lateral Displacement
- Division 1 Section 3 Subsection 6, Agreement
- Division 1 Section 4 Subsection 25, General Provisions
- DOT&PW Traffic Control Manual
- Federal Department of Consumer and Corporate Affairs

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Mix Design.** The Contractor shall designate the mix proportions and prepare the job mix formula. The aggregate and the polymer modified emulsified asphalt shall be assessed to confirm compatibility. The Contractor shall supply the results of a sand equivalency test for the aggregate.

All component materials used in the mix design shall be representative of the material proposed by the Contractor for use on the contract.

The Contractor shall submit to the Department the final mix design and the results of the tests listed in Table 4.16.1. The material shall not be placed until the Engineer has received the mix design.

Table 4.16.1 - Micro-Surfacing Mix Properties

| Test Name                                | Standard     | Requirement                   |
|------------------------------------------|--------------|-------------------------------|
| Wet Cohesion @ 30 minutes min. (Set)     | ISSA TB-139  | Minimum 12 kg-cm              |
| Wet Cohesion @ 60 minutes min. (Traffic) | ISSA TB-139  | Minimum 20 kg-cm              |
| Excess Asphalt by LWT                    | ISSA TB-109  | Maximum 538 g/m <sup>2</sup>  |
| Wet Stripping                            | ISSA TB-114  | Pass (90% min)                |
| Wet Track Abrasion Loss, 1 Hour Soak     | ISSA TB-100  | 538 g/m <sup>2</sup>          |
| Wet Track Abrasion Loss, 6 Day Soak      | ISSA TB-100  | 807 g/m <sup>2</sup>          |
| Lateral Displacement                     | ISSA TB-147A | Maximum 5                     |
| Classification Compatibility             | ISSA TB-144  | AAA, BAA 11 Grade Points Min. |
| Mix Time @ 25°C                          | ISSA TB-113  | Controllable to 120 Sec. Min  |
| Sand Equivalency                         | ASTM D2419   | 65 Min                        |

The micro-surfacing shall be designed so that traffic can be allowed on the surface within one hour.

## 4.0 MATERIALS

**4.1 Polymer Modified Emulsified Asphalt (Binder).** The binder shall be a quick set polymer modified cationic type CSS-1H emulsion or equivalent.

Emulsified asphalt and polymer modified asphalt shall be homogeneous after mixing and show no signs of

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## Section 16 Micro-Surfacing

separation within 14 days of delivery. The addition of polymers or other additives after the manufacture of the emulsified asphalt shall not be permitted.

The binder shall conform to the requirements of ASTM D 2397 for an emulsion, with the following amendments as detailed in Table 4.16.1.

**Table 4.16.2 - Polymer Modified Emulsified Asphalt**

| Test Name                              | Standard   | Requirement                    |
|----------------------------------------|------------|--------------------------------|
| Residue by Distillation, % by Mass     | ASTM D244  | Minimum 62%                    |
| <b>Tests on Residue</b>                |            |                                |
| Softening Point                        | ASTM D36   | Minimum 57°C                   |
| Penetration, (25°C, 100 g, 5 s), 0.1mm | ASTM D2397 | 40 - 90                        |
| Kenematic Viscosity @ 145°C            | ASTM D2170 | Minimum 650 mm <sup>2</sup> /s |

**4.2 Aggregates.** The aggregates shall consist of 100% crushed bedrock material.

**4.2.1 Stockpiling.** The Contractor shall construct stockpiles at sites of his own choosing. Such sites shall be arranged for, and shall be the responsibility of the Contractor, in all respects. Throughout the duration of the work there shall be sufficient aggregate in stockpile to cover three days production. If different sources of aggregate are to be used, separate stockpiles for each source are to be maintained.

The aggregates shall conform to the gradation requirements as detailed in Table 4.16.3.

**Table 4.16.3 - Aggregate Gradation**

| Sieve Designation | Cumulative Percent Passing | Stockpile Tolerance, % |
|-------------------|----------------------------|------------------------|
| 10 000            | 100                        | ± 5                    |
| 5 000             | 70-90                      | ± 5                    |
| 2 500             | 45-70                      | ± 5                    |
| 1 250             | 28-50                      | ± 5                    |
| 630               | 19-34                      | ± 5                    |
| 315               | 12-25                      | ± 4                    |
| 160               | 7-18                       | ± 3                    |
| 80                | 5-15                       | ± 2                    |

Once the gradation for the mix design has been submitted, the stockpile shall be within the tolerances shown under Stockpile Tolerances.

**4.2.2 Sampling.** The Department reserves the right to sample stockpiles to ensure the gradation conforms to that used in the mix design.

**4.3 Mineral Filler.** Mineral filler shall be free of lumps and shall not be air entrained.

**4.4 Water.** The water shall be potable and shall be free of harmful salts and contaminants.

**4.5 Polymer Modifier.** The polymer solids, along with special quick setting emulsifier agents shall be milled into the emulsified asphalt at the colloid mill.

The polymer modifier shall consist of a minimum of 3% polymer solids by mass.

**4.6 Additives.** Additives may be added to the emulsion mix during construction to provide control of the quick-set properties and increase adhesion. They must be compatible with the other components of the micro-surfacing.

## 5.0 CONSTRUCTION METHODS

### 5.1 General

**5.1.1 Weather Limitations.** The Contractor shall be responsible for determining under what weather conditions work on this contract may proceed. The Department, however, reserves the right to direct the Contractor to discontinue micro-surfacing operations



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when, in the opinion of the Engineer or selected representative, weather conditions endanger the traveling public.

**5.1.2 Documentation.** The Contractor shall submit to the Engineer, at the beginning of each working day, a written summary of the total quantity and distribution rate of micro-surfacing placed the previous day which shall include a list of the quantities used of each of the components; aggregate, emulsion, cement and additive.

**5.1.3 Protection of Work and Traffic Control.** The Contractor shall be responsible for providing traffic control required to protect the work zone and to ensure the safe passage of traffic in conformance with the DOT&PW Traffic Control Manual or as directed by the Engineer. Traffic control shall include traffic control persons, pilot vehicles with operators, signing and all other labour, equipment and material, excluding the supply of signs.

The Contractor shall be responsible for ensuring that the mixture is not damaged by traffic.

Traffic, including construction traffic, shall be kept off the freshly placed mixture for whatever time is required to prevent damage to the surface and until premarking of traffic lines with paint is complete.

**5.1.4 Trial Area.** At the commencement of the micro-surfacing operation the Contractor shall demonstrate the ability to produce and place micro-surfacing by placement of a trial area 100 m in length and one lane in width.

**5.1.5 Appearance.** The finished micro-surfacing shall have a uniform texture free from excessive scratch marks, tears or other surface irregularities. Tear marks in any 12 m<sup>2</sup> per-lane are considered excessive if there are:

- four or more marks 12 mm wide or wider and 100 mm or more long;
- any marks 25 mm wide or wider and 25 mm or more long.

There shall be no longitudinal ripples (raking) and wash-boarding (chatter) of 5 mm or more in depth as measured with a 3 m straight edge, or other irregularities that will affect the ride quality.

The edges of the micro-surfacing for surface application shall be uniform with neat appearance along the roadway centerline, lane lines, shoulder, pavement edge, and curb lines. Edges shall have no more than  $\pm 50$  mm horizontal variance in any 30 m section.

The finished surface shall be uniform and achieve a minimum British Pendulum Number (PDN) of 45 as measured with the British Pendulum Tester in accordance with ASTM E 303.

**5.1.6 Joints.** The longitudinal and traverse joints shall be neat and uniform in appearance. No excessive buildup, uncovered areas, non-homogeneous mixture or unsightly appearance shall be permitted on longitudinal or transverse joints.

The longitudinal joints in the scratch coat shall be constructed as a butt joint. The longitudinal joints in the surface course shall be placed on lane lines with less than 100 mm overlap on adjacent passes, except where pavement width varies i.e. ramps and tapers, and no more than 6 mm difference in elevation between the adjacent passes as measured with a 3 m straight edge.

Transverse joints shall be constructed with no more than 6 mm difference in elevation across the joint as measured with a 3 m straight edge.

**5.2 Equipment.**

**5.2.1 Brooms.** Power brooms shall be capable of cleaning gravel, sand, dirt and other debris from bituminous surfaces shall be used.

**5.2.2 Mixing Equipment.** The machine shall be specifically designed and manufactured to place micro-surfacing. The material shall be mixed by an automatic sequenced, self-propelled micro-surfacing mixing machine, which shall be a continuous flow mixing unit, able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving multi-blade double shaft mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls.

**5.2.3 Proportioning Devices.** Individual volume or weight controls for proportioning each material to be added to the mix (i.e. aggregate, mineral filler, emulsified asphalt, additive, and water) shall be provided and properly marked. These proportioning devices are usually revolution counters or similar devices and are used in material calibration and determining the material output at any time.

**5.2.4 Calibration of Proportioning Devices.** Prior to beginning placement of micro-surfacing, the Proportioning Devices shall be calibrated. A copy of the results of the calibration must be given to the Engineer prior to any micro-surfacing operation.

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Over the duration of the work, the Proportioning Devices shall be re-calibrated, should the following occur:

- After every 2000 t of aggregate placed throughout the duration of the contract.
- A change in the source of aggregate from that used in the previous calibration.
- Mechanical failure to the application system and/or Proportioning Devices in which repair is required.

**5.2.5 Straight Edges.** A 3 m straight edge shall be available that may be used to check for cross fall.

**5.2.6 Spreading Equipment.** The mixture shall be spread uniformly by means of a conventional augured surfacing spreader box attached to the mixing machine and equipped with paddles to agitate and spread the material evenly throughout the box. A front seal shall be provided to ensure no loss of the mixture at the pavement contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to maneuver the box to compensate for variations in the pavement geometry.

The rut filling spreader box shall be specifically designed for rut filling applications.

**5.2.7 String line.** A String line or other device must be provided to ensure the longitudinal edges are straight and meet the existing pavement edge or as directed by the Engineer.

### 5.3 Construction Sequence

**5.3.1 Surface Preparation.** The area to be surfaced shall be thoroughly cleaned of all vegetation, loose material, sand, dirt and other debris. Dried mud or other foreign matter, which cannot be removed with the rotary power broom, shall be removed by hand blade or other approved method. Water, if required, shall be applied to pre-wet the surface and immediately ahead of the spreader at a rate to dampen the surface without allowing any freestanding or free flowing water.

**5.3.2 Tack Coat** The area to be surfaced shall be covered with tack coat. The tack coat should consist of one part cationic polymer emulsified asphalt and three parts water and will be applied with a standard distributor. The distributor shall be capable of applying the dilution evenly at a rate of 0.16 to 0.32 litres per square metre. The tack coat shall be allowed to cure sufficiently before the application of Micro-Surfacing.

**5.3.3 Application.** The mixture shall be spread to fill minor cracks and shallow potholes and leave a uniform surface. The application shall consist of a scratch coat and a surface coat with a combined minimum application rate of 14 kg/m<sup>2</sup>.

Existing ruts greater than 10 mm shall be filled by separate application of micro-surfacing, with a rut filling spreader box, prior to the surface application.

Rut Fill Only application shall be specified where only the rut is to be filled with no surface application to follow. The mixture shall be confined to the immediate area of the rutting or as directed by the Engineer. Edges shall be feathered to blend into the existing cross slope.

Filled ruts shall have no depression. Overfill of ruts shall not exceed 3 mm per 25 mm of rut depth filled as measured with a 3 m straight edge.

For both types of application a sufficient amount of mixture shall be carried in all parts of the spreader box at all times so that complete coverage is obtained. Water may be sprayed into the spreader box to facilitate spreading without harming the mix. No lumping, balling, or unmixed aggregate shall be permitted in the finished surface. Any oversized aggregate or foreign materials shall be screened from the aggregate prior to delivery to the mixing machine.

**5.3.4 Handwork.** In restricted areas where hand spreading is necessary, slight adjustments to the mix formula may be used to retard the setting time. The mixture shall be poured into a small windrow along one edge of the surface to be covered. The mixture shall be spread uniformly with squeegees or other suitable hand tools.

**5.3.5 Rolling.** The micro-surfacing shall be rolled at the discretion of the contractor.

**5.3.6 Clean-Up.** All areas, such as shoulders and gutters, shall have the micro-surfacing mix removed as specified by the Engineer. The Contractor shall, on a daily basis, remove any debris associated with the performance of the work.

### 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Quality Control.** Quality control testing shall be the responsibility of the Contractor throughout every stage of the work, from and including, the production of the aggregates and polymer modified asphalt emulsion to the design and placement of the final product.

The Contractor shall provide the Engineer with a copy

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of all quality control test results within 24 hours of testing.

**6.2 Quality Assurance.** During the progress of the work, quality assurance testing may be conducted by the Department or its representative to ensure compliance with the specifications.

Results of the Quality Assurance testing will be available to the Contractor within 24 hours.

Quality Assurance testing performed by the Department or its representative shall not be considered to be quality control testing. Sampling and testing necessary to perform quality assurance monitoring will be at no cost to the Contractor.

**7.0 METHOD OF MEASUREMENT**

The method of measurement and payment shall be based on the area covered, measured in square metres.

**8.0 BASIS OF PAYMENT**

**8.1 Micro-Surfacing.** Payment for this item will be at the contract unit price per square metre of surface application.

Payment shall be full compensation for the supply, handling, transporting, mixing and placing of all materials, including tack coat and rut filling, the supplying of all equipment, plant, labour, incidentals and traffic control necessary to complete the work.

**9.0 WARRANTY**

**9.1 Initial Acceptance.** Initial acceptance of the work will be made provided all of the following conditions are met:

**9.1.1 Bleeding and Flushing.** The total of areas exhibiting bleeding and flushing shall not exceed two percent in any 100 m<sup>2</sup> area. No bleeding at the joints shall be permitted.

**9.1.2 Surface loss (debonding, delamination and/or potholing).** The total of areas exhibiting loss of surface shall not exceed two percent in any 100 m<sup>2</sup> area.

**9.1.3 Raking and Chatter.** The total of areas exhibiting raking and chatter shall not exceed two percent in any 100 m<sup>2</sup> area.

**9.1.4 Ruts.** The total of areas exhibiting ruts exceeding 6 mm below grade, as measured with a 3 m straight edge, shall not exceed two percent in any 30 m lane segment. The warranty period for rutting

shall be sixty (60) days after placement has been accepted by the Engineer. The warranty period shall apply to both initial placement and repairs.

**9.1.5 Surface Friction.** At the end of the maintenance period the surface shall have a uniform texture and a minimum BPN of 45 as measured with the British Pendulum Tester in accordance with ASTM E 303.

**9.2 Maintenance / Repair Period**

Upon completion of the Micro-Surfacing and visual acceptance of the work in accordance with these specifications, a two year maintenance period will begin. During this period any failure in the Micro-Surfacing, including but not limited to raking, chatter, raveling, potholes, delamination, debonding, over rich or bleeding areas shall be repaired or reconstructed at the Contractor's expense to the satisfaction of the Engineer. Any 400 m lane segment that has defects exceeding five percent of the area shall require a reapplication of micro-surfacing over the entire segment. All material, haul and related work required for reconstruction of unacceptable areas shall be paid by the Contractor.

At the discretion of the Engineer, any failure in the Micro-Surfacing within the first 12 months of the maintenance period, deemed to be a hazard to traffic, shall be repaired by the Contractor immediately.

**9.3 Final Acceptance.** The Department or its representatives, and the Contractor will meet and inspect the Micro-Surfacing prior to the expiration date of the two year maintenance period.

Based on the aforementioned criteria for initial acceptance, if the Contractor and the Department do not agree on what areas are failed, the Department's decision shall be final. All areas that have failed shall be repaired at the Contractor's expense at no cost to the Department.

The final acceptance of the original Micro-Surfacing by the Department shall relieve the Contractor from all maintenance responsibility with respect to the original Micro-Surfacing, however, the Contractor shall be held responsible to maintain repaired areas for a period of 12 months after repairs are made.

**9.4 Liability.** During the period of construction and the one year maintenance period the Contractor shall be responsible for processing any and all claims for property damage and/or bodily injury caused by failure of the Micro-Surfacing including but not limited to motor vehicle or pedestrians. The Contractor shall be responsible for the payment of all property damage and bodily injury claims and agrees to save and hold

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harmless the Department from all such claims as set out in Division 1 Section 4 Subsection 25 of these specifications. Claims not handled by the Contractor or representative efficiently or expediently will be settled by the Department and the costs recovered from the Contractor.

**9.5 Security Deposit.** Notwithstanding anything to the contrary, and as stated in Division 1 Section 3 Subsection 6 of these specifications, the security deposit for this contract shall be held and retained by the Minister until the maintenance period has expired.

The security deposit will be held to ensure that sufficient funds will be available to the Department in the event of non-performance by the Contractor who is responsible for all costs including the materials and haul and for the repair of all failures and damages resulting from negligence or faulty workmanship by the Contractor that adversely affects the integrity of the Micro-Surfacing which occurs and is evident prior to the expiration of the one year maintenance period. The amount of security deposit shall be approximately 20% of the estimated value of the tender.



## Division 4 Pavements

## Section 17 Concrete Pavement

## SECTION 17 - CONCRETE PAVEMENT

## 1.0 DESCRIPTION

This section covers the requirements for materials and methods for the construction of Portland Cement concrete pavements. It also describes formwork, placement, finishing, curing and basis of payment.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- AASHTO Designation M31, Plain, Round, Steel Dowels
- AASHTO Guide Specification for Highway Construction (1984)
- ACI 309 (Revised 1982), Standard Practice for Consolidation of Concrete
- ANSI/ACI 117, Tolerances for Concrete Construction and Materials
- ASTM A 775-M, Epoxy Coated Reinforcing Bars
- ASTM C 174, Test Method for Measuring Length of Drilled Concrete Cores
- ASTM C 260, Air-Entraining Admixtures for Concrete
- ASTM C 309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM C 457, Practice for Microscopical Determination of Air Void Content and Parameters of the Air Void System in Hardened Concrete
- ASTM C 494M, Chemical Admixtures for Concrete
- ASTM C 496, Test Method of Splitting Tensile Strength of Cylindrical Concrete Specimens.
- ASTM C 666, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thaw
- ASTM C 684, Method of Making, Accelerated Curing and Testing of Concrete Compression Test Specimens.
- ASTM C 1064, Temperature of Freshly Mixed Portland Cement Concrete
- ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
- ASTM D 1751, Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
- ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
- CSA 283-M, Qualification Code for Concrete Testing Laboratories
- CSA-A5, Portland Cement
- CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- CSA-A23.2, Methods of Test for Concrete
- CSA-A23.5, Supplementary Cementing Materials
- CSA-A362, Blended Hydraulic Cement
- CSA G30.16-M, Weldable Low Alloy Steel Deformed Bars for Concrete Reinforcement
- CSA G30.18, Billet Steel Bars for Concrete Reinforcement
- CSA S269.3, Concrete Formwork
- Division 3 Section 11, Unshrinkable Backfill
- Division 5 Section 7, Cast-in-Place Concrete
- Division 2 Section 6, Subgrade

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The Contractor's method of protection of the work from cold weather shall be submitted in writing to the Engineer at least two weeks before the protection is required.

Three sets of shop drawings for load transfer devices shall be submitted at least three weeks before commencement of fabrication. These drawings shall include support details, details of all materials and fabrication methods.

## 4.0 MATERIALS

**4.1 Subgrade Materials.** Material used to backfill structures shall be unshrinkable backfill or material similar to material removed from the trench. Frozen lumps of earth or rocks greater than 100 mm in diameter shall not be permitted.

**4.2 Subbase Materials.** Granular subbase for concrete pavement shall conform to the gradation requirements in Table 4.17.1 and the physical properties of Table 4.17.2. The subbase shall have a compacted thickness of not less than 150 mm. The specified gradation shall be verified prior to placing material on the roadway.

Table 4.17.1 Granular Subbase Gradation

| Sieve Size (µm) | Percent Passing |
|-----------------|-----------------|
| 40 000          | 100             |
| 10 000          | 30 - 65         |
| 5 000           | 25 - 55         |
| 2 500           | 15 - 45         |
| 630             | 10 - 25         |
| 80              | 2 - 5           |



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**Table 4.17.2 Physical Properties for Granular Subbase**

| Test                      | Limits | Test Method |
|---------------------------|--------|-------------|
| Fractured Particles (min) | 80     | DOT&PW      |
| Petrographic Number       | 160    | DOT&PW      |
| Absorption % (max)        | 1.75   | ASTM C 127  |
| Plasticity Index          | 0      | ASTM D 4318 |
| Micro Deval % (max)       | 25     | DOT&PW      |

**4.3 Concrete Materials.** Concrete and concrete materials shall conform to Division 5 Section 7 with the following exceptions and/or additions:

- The design of the concrete mixture shall be the responsibility of the Contractor and must be approved by the Engineer prior to execution of the work.
- The Petrographic Number for aggregates used in concrete production shall not exceed 135.
- The nominal size of the coarse aggregate shall be 20 to 40 mm. Equipment limitations and production facilities may dictate the smaller aggregate size.
- Aggregate for the concrete shall be non-alkali aggregate reactive, as shown by recent (within last two years) laboratory testing in accordance with latest addition of CSA A23.2-14A or have a satisfactory service record in similar environments. Satisfactory service record means that there is no evidence of alkali aggregate reaction within a service life of 15 years.
- Aggregate for concrete shall not be susceptible to D-cracking. Concrete prisms shall be tested in accordance with ASTM C 666 Procedure A for 350 cycles. At end of 350 cycles the maximum allowable expansion shall be 0.035%.
- The concrete shall have a flexural strength of 4.85 MPa at 28 days or as specified in the Special Provisions.
- The minimum cementing material content shall be 360 kg/m<sup>3</sup>.
- Low calcium (less than 10% CAO) Class F fly ash may be used at an addition rate not to exceed 15 percent by mass of total cementing material.
- The maximum water to cementing materials ratio shall be 0.45.
- The slump at the point of discharge shall be 45 mm  $\pm$  20 mm.
- The air content at the time and point of discharge shall be 6.5  $\pm$  1%. The air void parameters shall be determined on the proposed concrete mixture design and shall be as specified in latest edition of CSA A23.1.
- The temperature of the concrete at point of discharge shall be 10°C to 27°C.

**4.4 Tie Bars and Dowels.**

**4.4.1 Tie Bars.** Tie bars shall be 15M epoxy coated deformed reinforcing bars conforming to the requirements of ASTM A 775.

**4.4.2 Dowels.** Dowel dimensions shall be as indicated on the contract drawing. Dowels shall be epoxy coated, smooth, straight and free from deleterious material. The free ends shall be beveled. For half their length, the dowels shall be coated with a bond-breaking compound, such as oil or a form release agent or be enclosed in a tight-fitting plastic sheath.

**4.5 List of Acceptable Rubberized Asphalt Joint Sealants.**

| Source                                                                                                                            | Product                       | Pour Temp, °C          |
|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------|
| Baker Inc<br>284 Watline Ave<br>Mississauga, Ontario<br>L4Z 1P4 (416) 890-4800<br>FAX (416) 890-4866                              | WI 317                        | 175-190                |
| Bitumar Inc<br>11650 Boul Metropolitan Est<br>Montreal, Quebec<br>H1B 1A5 (514) 645-4561<br>FAX (514) 645-6978                    | Superflex 80<br>Superflex 100 | 170-190<br>170-190     |
| Crafco Inc<br>6975 W Crafco Way<br>Chandler, Arizona, USA<br>85226 (602) 276-0406<br>Watts (800) 526-8242<br>FAX (602) 961-0513   | Crafco 34211                  | 190-210                |
| Hydrotech Membrane Corp<br>110 West Beaver Creek Rd<br>Unit 13<br>Markham Ontario<br>L4B 1J9 (416) 764-9655<br>FAX (416) 764-9649 | Sealz 6160                    | 185-205                |
| Koch Materials Co<br>43 Industrial St<br>Toronto Ontario<br>M4G 1Z2 (416) 421-2552<br>FAX (416) 421-2378                          | 9001                          | 180-205                |
| WR Meadows of Canada Ltd<br>70 Hannant Crt<br>Milton Ontario<br>L9T 5C1 (416) 542-7220<br>FAX (416) 878-4125                      | 164<br><br>Hi-Spec            | 188-199<br><br>188-199 |
| Permaquik Corp<br>1591 Trinity Dr<br>Mississauga Ontario<br>L5T 1K4 (416) 564-6100<br>FAX (416) 564-6110                          | Permaquik<br>619J             | 190-200                |
| Note: For all of the above products, method of application is either by pressure or gravity feed.                                 |                               |                        |

**Division 4 Pavements****Section 17 Concrete Pavement****5.0 CONSTRUCTION METHODS**

**5.1 Weigh Scales.** Weigh scales shall be installed and maintained in accordance with Division 1 Section 39 of the Standard Specification.

**5.2 Water for Compaction, Dust Control and Dampening Subbase.** At least one mobile unit of not less than 4,500 l capacity for applying water shall be available for use on the project at all times.

**5.3 Subgrade Preparation.** The installation of all utility mains and/or structures, where possible, shall be completed before the commencement of base construction or concrete paving. All utility trenches within the pavement area shall be backfilled to subgrade level to the requirements of the Engineer.

Excavation backfill shall be compacted in accordance the requirements as detailed in Division 2 Section 8 of these specifications. Unshrinkable backfill may be used where indicated or approved by the Engineer.

The subgrade shall be proof rolled by means of a vibratory roller with a minimum static mass of 8 tonnes and dynamic mass of 20 t. All soft and yielding material, as observed by the Engineer, shall be removed and replaced with suitable material.

Additional base material shall be placed as shown on the drawings.

**5.4 Subbase Preparation.** The subbase material shall be compacted using the control strip method as outlined in Division 3 Section 5 of these specifications.

The base shall extend beyond the pavement edge as shown on the drawings.

The prepared subbase shall be checked for conformity with the cross-section and grade tolerances of  $\pm 10$  mm specified using an approved scratch template, or other method approved by the Engineer. In-place material shall be adjusted to comply with the tolerances by recompaction, and again checked.

Prior to placing the concrete, the subbase shall be thoroughly wetted. Wetting shall be carried out such that standing water is not present on the surface.

**5.5 Formwork and Guide Lines.**

**5.5.1 Formwork.** All formwork shall conform to Division 5 Section 7.

**5.5.2 Guide Lines for Slip-Form Paving.** Guide lines shall be provided at a constant height above, and at a constant horizontal distance from, the edge of the proposed pavement.

Guide lines shall be supported from steel pins by connectors capable of fine horizontal and vertical adjustment.

The pins shall be positioned, connectors set, and the guide lines tensioned on the connectors by the Contractor sufficiently in advance of the paver to permit inspection and checking.

**5.6 Tie Bars and Dowels.**

**5.6.1 Tie Bars.** Tie bars shall be used at all longitudinal joints.

Tie bars shall be clean and shall be inserted in such a manner that voids are not created around the bar.

Tie bars shall be located at the mid depth of the slab as shown on the drawings and installed such that the location does not deviate more than 20 mm from the location shown.

Tie bars shall not be placed within 450 mm of a transverse joint.

**5.6.2 Dowels.** Dowels shall be placed in assemblies at transverse joint locations in advance of the concreting operation, or by a dowel implanter machine during concrete placing and spreading. Dowel assemblies must be fixed to the subbase so they will remain stable and undisturbed during the paving operation.

Dowels shall be evenly spaced and placed parallel to each other and parallel to both the pavement centre line and the pavement surface.

Placing Tolerance - deviation of not more than one degree from alignment of the pavement; and parallel to each other, within a tolerance of 0 degrees and 45 minutes.

Dowel locations shall be visibly marked by the Contractor on the form, adjacent slab or by stakes or pins on the shoulder to permit accurate location for joint-forming operation.

**5.7 Concrete Production, Transportation and Placing.**

**5.7.1 Concrete Production.** Concrete shall be produced in accordance with Division 5 Section 7.

**5.7.2 Transporting Concrete.** The concrete mixing, delivering and spreading operations shall be co-ordinated as to provide a uniform rate of progress of the paving equipment, with stopping and starting of the paver held to a minimum.

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**5.7.2.1 Delivery with Non-agitating Equipment.** Concrete that is completely mixed in a stationary mixer may be transported in non-agitating equipment. The bodies of such equipment shall be smooth, water tight, steel containers equipped with gates that will permit control of the discharge of the concrete.

Covers shall be used to provide protection during inclement weather.

Discharge of concrete shall be complete within 60 minutes after introduction of the mixing water to the cement and aggregates.

**5.7.2.2 Delivery with Agitators or Truck Mixers.** After completion of mixing, concrete may be transported to the site by means of agitator trucks or truck mixers. The equipment shall be operated at the speed of rotation designated by the Manufacturer of the truck at the agitating speed.

The concrete shall be delivered to the site, in a thoroughly mixed and uniform mass, and discharged with the uniformity required.

Concrete shall be transported to its final position such that segregation or loss of slump is minimized and the concrete has the required workability at the point and time of discharge.

Delivery equipment shall not operate from previously paved lanes until the pavement is at least 7 days old or the concrete has achieved 75% of its specified flexural or compressive strength. If equipment operating in the paving lane causes rutting or displacement of the base or subbase, smaller loads, suitable runways, tracked equipment or combinations of these procedures shall be used.

**5.7.3 Placing.** Concrete shall be placed on dampened subbase, and as close as possible to its final position, so as to minimize rehandling.

Placing shall be continuous between planned transverse joints without the use of intermediate bulkheads. When an interruption in placing concrete of more than one hour occurs, a transverse construction joint shall be formed immediately, unless otherwise directed by the Engineer.

When required, hand spreading of concrete shall be done with shovels, not rakes.

Workers shall not be permitted to walk in freshly placed concrete with their boots coated with deleterious material.

The concrete shall be placed or subsequently distributed to an even depth ahead of the screw feed augers. The machine shall spread, screed, compact and float finish the concrete in one pass.

Concrete shall be placed as near as possible to a dowel assembly, but shall not be dumped directly onto the assembly so as to cause misalignment.

Concrete shall not be placed on snow or ice or on a frozen subbase or subgrade.

**5.8 Consolidation, Finishing, Surface Tolerances.**

**5.8.1 Consolidation.** Concrete shall be thoroughly consolidated against and along the face of all forms and into the face of previously placed concrete.

For fixed-form paving with vibrating screeds, hand-held vibrators shall be used to supplement consolidation adjacent and along the full length of the form. They shall also be inserted at regularly spaced intervals along both sides of dowel assemblies. The vibrators shall not come in contact with the subgrade, subbase, forms, tie bars or dowel assemblies. Vibrators shall not be operated longer than 15 seconds in any one location.

For slip-form pavers, the concrete shall be consolidated by internal vibrators of sufficient number, spacing and frequency to provide uniform consolidation to the entire pavement width and depth. The vibrators shall not come in contact with the subgrade, subbase, tie bars or dowel assemblies. The vibrators shall not operate while the paver is stopped and shall be positioned between and parallel to dowel bars.

Vibration procedures shall conform to ACI 309.

**5.8.2 Finishing.** Adding water to the surface of the concrete to assist the finishing operation shall not be permitted. A fine spray of water shall be permitted only to prevent shrinkage cracking caused by rapid evaporation of surface moisture after finishing and texturing operations are completed. Only approved spray equipment shall be used.

Following strike-off and consolidation, the concrete pavement shall be scraped with an aluminum or magnesium straightedge 3 m long, equipped with a handle to permit operation from the edge of the pavement. All excess water or laitance shall be removed from the surface before scraping commences.

Use of wood floats shall not be permitted.

The edges of the slab shall be finished with an edging tool having a radius not more than 6 mm.

Texturing shall be performed full width and parallel to transverse joints to produce transverse grooves 2 mm to 4 mm wide on 15 mm to 20 mm centres with a groove depth 3 mm to 5 mm using a steel tine.

The surface shall be free from displaced aggregate particles and local projections.



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Pavement protection shall be employed when rain, sufficient to mar the texture of the concrete surface, is expected.

Concrete shall not be placed during rain. Any damage caused by rain shall be repaired or pavement replaced at the Contractor's expense.

**5.8.3 Surface Tolerance.** The finished surface shall be tested for smoothness by use of a 3 m long straightedge placed parallel to the centre line of the pavement in each wheel line and/or by use of a mechanical multiple wheel profilograph to determine the Profile Index. Ordinates measured from the face of the straightedge to the surface of the pavement shall at no place exceed 6 mm.

Smoothness Testing shall be as specified in the special provisions for the contract or as stated in the standard specification.

Areas that do not meet the required surface accuracy shall be clearly marked out, and the Contractor shall, at his own expense:

- Grind down any areas higher than 6 mm but not higher than 12 mm above the correct surface, as measured by the straight-edge.
- Correct any areas lower than 6 mm but not lower than 12 mm below the adjacent concrete surface as measured by the straight edge by grinding down the adjacent high areas.
- Break out and replace sections where the straightedge deviation exceeds 12 mm from the correct surface. The volume of concrete removed and the method of removal shall permit the formation of a new slab of the required quality which is in no way inferior to the adjacent undisturbed slab.

All grinding shall be carried out by an approved machine of a type and capacity suitable for the total area of grinding involved until the surface meets the specified requirements. The surface texture requirements of this specification shall be required following the grinding operation. In no case should the specified thickness of pavement be reduced due to grinding.

**5.9 Curing and Protection.** As soon as practical, after the texturing operation is completed, the entire pavement surface, including exposed sides, shall be cured by protecting it against loss of moisture, rapid temperature change and mechanical injury, in accordance with the requirements of Division 5 Section 7.

The Contractor shall have the material and equipment needed for adequate curing on hand and ready to install before actual concrete placement begins. If the curing procedure requires the use of water, the Contractor shall have adequate water supply available on site.

White liquid membrane-forming curing compounds shall be applied to the exposed surface and edges of slip-formed pavement or the surface of formed concrete pavement following the final texturing operation. Complete and uniform coverage, at a rate of 3 to 4 m<sup>2</sup>/L shall be required. The compound shall be kept agitated to prevent pigment from settling. It shall be applied to the pavement edges of formed pavement immediately following the removal of the forms.

Curing compound shall to be removed by the Contractor if bond cannot be achieved between the paint used for pavement markings and the concrete.

Membrane curing compound shall not be applied to joint faces receiving sealant.

Concrete pavement shall have a minimum 30 day air drying period, following final curing, before the first application of deicing salts.

**5.10 Jointing.** Transverse contraction control joints, and all longitudinal control joints shall be constructed and located as indicated on the drawings, or as required by construction operations.

Transverse and longitudinal control joints shall consist of planes of weakness created by cutting vertical grooves in the pavement surfaces or depending on construction methods, the longitudinal joint may be formed.

Transverse control joints shall extend to one third the depth of the slab.

Sawed transverse control joints shall be located on the surface of the pavement by the Contractor with suitable markings in advance of sawing. Sufficient saws and blades shall be available to maintain continuity of work and timely sawing. Standby equipment shall be available in the event of equipment breakdown.

Sawing shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually within 12 hours. Joints shall be sawn during day and night, if necessary, in order to prevent uncontrolled shrinkage cracking.

Sawing of any joint shall be omitted if a random crack has developed at or near the joint location before the time of sawing. Sawing shall be discontinued if a crack develops ahead of the saw. When a crack occurs ahead of the sawing, usually as a result of sawing too late, remedial measures may be required, such as sawing every third or fourth joint followed by sawing the intermediate joints.

Sawed grooves forming a reservoir for joint sealant shall be formed by one of the following methods:

- In two stages, first, by cutting a narrow (3 mm) groove to the required saw cut depth and second, by widening the initial groove by secondary sawing to

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the required sealant-reservoir dimensions.

- In one operation, using two different diameter (and width) blades simultaneously to achieve the required sealant-reservoir dimensions.

Concurrent with the sawing operation, the grooves shall be cleaned of laitance and grit by high pressure water jets.

Control joints in adjacent lanes shall be constructed at the same chainage.

If extreme anticipated conditions make it impractical to prevent erratic cracking by early sawing, the transverse control joints shall be formed before the initial set of the concrete. Formed transverse control joint grooves shall be made by depressing a tool or device into the plastic concrete the required depth and the full width. The tool or device shall remain in place until the concrete has attained its final set and shall then be removed without disturbing the adjacent concrete.

The concrete surface shall be finished by floating across the formed groove, and retextured if required.

Transverse control joints may also be formed by installing a parting strip to be left in place, the required depth and full width. Parting strips shall not be depressed below the pavement surface but shall be flush with the surface.

Transverse construction joints of the type shown on the drawings shall be placed whenever the placing of concrete is to be suspended or interrupted for more than one hour. Dowel alignment through the bulk head shall meet standards set in Subsection 5.6.

Longitudinal control joints shall consist of planes of weakness created by cutting or forming grooves in the surface of the pavement at the locations shown on the drawings. The depth of the grooves shall be at least one-third the depth of the slab or as specified.

Longitudinal construction joints shall be edged with a 6 mm radius edger and textured to match adjacent concrete.

**5.11 Joint Sealing.** Joint sealing will not be permitted in wet or cold weather.

Joints shall be prepared by saw cutting or forming as described in Subsection 5.10 or as shown in the contract drawings.

Immediately prior to sealing operations, all joint faces shall be abrasive blast cleaned and then cleaned and dried with an oil free hot compressed air lance. Following cleaning a bond breaker approved by the Engineer shall be placed at the base of the reservoir cut.

The joint sealant material shall be a hot poured

rubberized asphalt or preformed neoprene sealant as shown in the contract drawings and installed in accordance with the Manufacturer's written instruction.

**5.11.1 Rubberized Asphalt Sealant.** Joint sealant shall not be applied prior to 21 days of concrete curing.

The joint sealing compound shall be melted uniformly and slowly while being stirred constantly in the heating kettle. The compound shall be heated until it can be drawn free flowing and lump free from the heating and mixing kettle at a temperature within the range specified by the Manufacturer of the compound. It shall be poured within the specified temperature range.

Sufficient compound shall be poured into the joint so that, upon completion of the work, the surface of the compound shall be 3 mm to 6 mm below that surface of the pavement. If the compound subsides to a level below that indicated above, a second pouring will be required. When more than one pouring is required to fill the joint, succeeding pours shall be made immediately. The sealant shall be prevented from flowing beyond the edge of the slab. Longitudinal joints shall be sealed immediately following the sealing of the transverse joints in the adjacent lane.

Any material spilled or excess material in the joint shall be removed immediately and the pavement surface cleaned.

**5.11.2 Preformed Neoprene Sealant.** The joint shall be sealed immediately following the concrete curing period and completion of joint cutting and cleaning.

The sequence of installation and the joint sealing procedure shall be in accordance with the Manufacturer's written instructions.

**5.12 Opening to Traffic.** The pavement shall not be opened to traffic until specimen cylinders or beams conforming to the requirements of the specification have attained 75% of the design strength of concrete, either as flexural strength when tested by the third-point loading method, or as compressive strength. If such tests are not conducted, the pavement shall not be opened to traffic until 10 days after the concrete has been placed. Before opening to traffic, the pavement shall be cleaned, joints shall be sealed and all markings completed.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Quality Control.** The Contractor shall take all control measures required to construct the concrete pavement in accordance with the specification.

**6.2 Quality Assurance.** The quality assurance procedure of the Department shall not be used to replace or augment the quality control by the Contractor. Testing of the concrete during placing shall be in accordance to Division 5 Section 7 and as



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amended by the following clauses.

The standard test for assessing the strength of concrete will be the flexural test as per CSA A23.2-3C and CSA A23.2-8C. Compressive strength tests of cylinders in accordance with CSA A23.2-3C and CSA A23.2-9C may also be used to assess the suitability and uniformity of the concrete. Conformance testing will be the responsibility of the Owner.

The frequency of tests for compressive strength shall conform to the requirements of CSA A23.1. The frequency of tests for flexural strength shall be as for the compressive strength.

Prior to construction or concurrent with construction a correlation may be established between flexural strength and compressive strength. On the basis of the correlation, the required strength may be expressed in terms of flexural or compressive. The Contractor shall then be required to meet or exceed the determined compressive strength as well as the flexural strength.

Cores shall be drilled from the pavement to determine insitu compressive strength and slab thickness. Core compressive strengths may be used to determine the length of time required prior to allowing the pavement to be put into service.

Cores will be the basis of acceptance for slab thickness. One core shall be drilled for every 1000 m<sup>2</sup> of pavement surface area. No core shall be drilled within 250 mm of any joint or edge of slab. All cores shall be 100 mm nominal diameter. Cores shall be measured for slab thickness in accordance with ASTM C174.

Core holes in the pavement shall be filled immediately after coring with a concrete repair material approved by the Engineer. The patch shall be finished flush with the surrounding surface. Immediately prior to filling, the vertical surface of the hole shall be cleaned of any paste remaining from drilling and all free water shall be removed. After filling, all excess material shall be removed from the slab surface.

Cores shall be tested in compression according to CSA A23.2-14C at the age desired to put the pavement into service, or at 28 days. All cores shall be moist cured until the time of test.

**7.0 METHOD OF MEASUREMENT.**

**7.1 Water for Compaction, Dust Control and Dampening Subbase.** The method of measurement shall be the number of kiloliters used for compaction, dust control and dampening subbase.

**7.2 Common Excavation.** The area to be excavated shall be determined by proof rolling or as directed by the Engineer. The volume shall be the number of cubic meters as shown on the cross section between the

original position of the ground line as measured before the excavation of material and the lines of the completed and accepted excavation. The volume shall be computed by the average end area method.

**7.3 Compaction.** The quantity of compaction to be paid for under this item shall be the number of cubic meters of compacted material placed in the excavation area or as directed by the Engineer. The volume paid shall be as shown on the cross section between the accepted final position of the excavation and the lines of the completed and accepted top of subgrade. The volume shall be computed by the average end area method.

**7.4 Fine Grading of Subgrade.** The quantity of fine grading to be paid for shall be the actual number of square meters of fine grading prepared in accordance with the plans, or as directed by the Engineer, on which the granular subbase for concrete pavement is to be placed. Fine grading and disposal includes:

- Removal and disposal of surplus subgrade
- Deleterious material (grass, bushes, alders), and
- Proof rolling (considered incidental)

**7.5 Supply & Install Geotextile.** The quantity of geotextile, if used, shall be paid per square meter for material placed as directed. This measurement shall not include the required lapping of material at joints.

**7.6 Granular Subbase for Concrete Pavement.** The quantity of granular subbase shall be per tonne as weighed on the Contractor's scale.

The quantity of granular subbase for concrete pavement placed in stockpiles shall be per tonne as determined by the Engineer.

**7.7 Portland Cement Concrete Pavement.** The quantity of portland cement concrete pavement shall be the area in square metres computed from the dimensions shown on the drawings or as revised by the Engineer.

**8.0 BASIS OF PAYMENT**

**8.1 Water for Compaction, Dust Control and Dampening Subbase.** Water for compaction and dust control will be paid at the contract unit price bid per kilolitre. This price shall be full compensation for furnishing, handling, transporting and applying water, and for the supplying of all equipment, plant, labour and incidentals necessary to complete the work.

**8.2 Common Excavation.** The volume of common excavation measured will be paid at the contract unit price bid for common excavation. This price shall be full compensation for the excavation, trimming of slopes, disposal of surplus and waste materials, preparation and completion of subgrade, shoulders and roadway, and the furnishing of all equipment, tools,

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labour and incidentals necessary to complete the work.

**8.3 Compaction.** The quantity of compaction as specified will be paid at the contract unit price bid for compaction. This price shall be full compensation for the work described in this section including the furnishing of all equipment, labour, materials and incidentals necessary to complete the work. No payment will be made for material placed beyond the plane measured 1 m horizontally from the outside of the theoretical embankment slope.

**8.4 Fine Grading of Subgrade.** Fine grading will be paid at the contract unit price per square metre. This price shall be full compensation for all scarifying, shaping, trimming, filling and rolling, handling and disposal of all surplus material, and for the furnishing of all equipment, plant, labour and incidentals necessary to complete the work. Fine grading shall not be paid for more than once for any area.

**8.5 Supply & Install Geotextile.** The price for supply and install geotextile shall be at the contract unit price per square metre. This price shall be full compensation for the supply and installation of geotextile and shall also include all equipment, labour

and incidentals necessary to complete the work.

**8.6 Granular Subbase for Concrete Pavement.** Payment for granular subbase will be paid at the contract unit price per tonne, complete in place. The price shall be full compensation for the furnishing of all materials, equipment, labour, compaction and incidentals necessary to complete the work. Payment for material in stockpile will be paid as per Division 3 Section 2 of these specifications.

**8.7 Portland Cement Concrete Pavements.** Payment for portland cement concrete pavements shall be made at the contract unit price bid per square metre.

The payment for portland cement concrete pavements shall be considered full compensation for the preparation of and furnishing all materials, aggregates, cement, supplementary cementing materials, water, admixtures and other materials, all joints and joint filler materials, tools, equipment, falsework, forms, bracing, labour, surface finish, curing and all other items of work required to complete the work as shown on the plans and as outlined in the specifications.

**9.0 WARRANTY**

## Division 4 Pavements

## Section 18 Roller Compacted Concrete (WS)

## SECTION 18 - ROLLER COMPACTED CONCRETE - (WS)

## 1.0 DESCRIPTION

The work covered by this section consists of the provision of all plant, materials, labour and equipment for the production, placing, compacting and curing of Roller Compacted Concrete pavement (RCC).

## 2.0 REFERENCES

All reference standards shall be the current issue or latest revision at the first date of the tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 171, Specification for Sheet Materials for Curing Concrete
- ASTM C 1040, Density of Unhardened and Hardened Concrete In-Place by Nuclear Methods
- ASTM C 309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM C 260, Air-Entraining Admixtures for Concrete
- ASTM C 494, Chemical Admixtures for Concrete
- ASTM C 666, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thaw (aggregate durability)
- ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
- ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
- ASTM C 457, Practice for Microscopical Determination of Air Void Content and Parameters of the Air Void System in Hardened Concrete
- ASTM C 496, Test Method of Splitting Tensile Strength of Cylindrical Concrete Specimens
- CAN/CSA-A362, Blended Hydraulic Cement
- CAN/CSA 283-M, Qualification Code for Concrete Testing Laboratories
- CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- CSA-A23.2, Methods of Test for Concrete
- CSA-A5, Portland Cement
- CSA-A23.5, Supplementary Cementing Materials
- Division 2 Section 6, Subgrade
- Division 4 Section 17, Concrete Pavement
- Division 5 Section 7, Cast-in-Place Concrete

## 3.0 SUBMISSION AND DESIGN REQUIREMENTS

**3.1 General.** A RCC mix design shall be submitted to the Engineer for approval at least four weeks prior to commencing work. The mix design report shall be signed by a Professional Engineer registered to practise in the Province of Nova Scotia, and shall summarize cementitious materials, compressive and flexural strengths for the proposed mix and required

density after placement. This report shall also include documentation indicating that the proposed aggregates meet the specified requirements.

**3.2** Additional submittals are to be received by the Engineer at least two weeks before the start of RCC placement. These include:

- Contractor's construction schedule for RCC work.
- RCC laydown pattern showing:
  - direction of paver
  - paving width
  - daily production
  - curing pattern
  - planned longitudinal and transverse cold joints
- Manufacturer's data and specifications for mixing plant, hauling, placing, laydown and compaction equipment.
- Layout of plant showing location, aggregate storage, water supply and mixing plant.
- Methods of handling, storing, delivery and mixing of materials.
- Procedure for placing, compacting and curing RCC.
- Method of protection of the work from cold weather, which shall be submitted in writing to the Engineer at least two weeks before the protection is required.

## 4.0 MATERIALS

**4.1 Concrete Materials.** All materials used in the production of RCC shall conform to Division 5, Section 7 and the referenced standards with the following exceptions and/or additions:

- The design of the RCC mixture shall be the responsibility of the contractor and must be approved by the Engineer prior to execution of the work.
- The Petrographic Number for coarse aggregates used in RCC production shall not exceed 140.
- The nominal size of the coarse aggregate shall be 20 mm.
- The RCC shall have a flexural strength of 4.30 MPa at 28 days or as specified in Special Provisions.
- The minimum cementing material content shall be 360 kg/m<sup>3</sup>.
- Type 10 cement shall be used.
- Low calcium Class F fly ash may be used at an addition rate not to exceed 20 percent by mass of total cementing material.
- Silica fume cement may be used at an addition rate not more than 10 percent by mass of total cementing material.
- Air entrainment admixture shall be added at twice the manufacturers recommended dosage.
- The temperature of the concrete at point of discharge shall be 10°C to 27°C.

## Division 4 Pavements

## Section 18 Roller Compacted Concrete (WS)

## 5.0 CONSTRUCTION METHODS

## 5.1 Equipment and Plant

**5.1.1 Mixer.** The mixer unit shall be a stationary mixer of the twin shaft pugmill type or central concrete batch plant capable of producing a minimum output of 150 t/hr.

**5.1.2 Aggregate Bins.** Aggregate bins shall be provided for aggregate storage and shall be of sufficient capacity to provide a continuous supply to the mixer operating at full capacity.

The bins shall have the feed rate controlled by a variable speed belt, calibrated to accurately deliver any specified quantity of material within the required tolerance.

**5.1.3 Water Control Units.** Satisfactory means of incorporating either weighing, metering or volumetric measurements, shall be provided to obtain the required quantity of water in the RCC mix within the specified tolerances. A water storage tank shall be provided to prevent surge draw down effect.

**5.1.4 Batching and Proportioning Tolerances.** Batching or proportioning shall conform to the mixture proportions as directed, with the following tolerances:

| Material               | Plant |
|------------------------|-------|
| Cementitious materials | ± 1 % |
| Aggregates             | ± 2 % |
| Water                  | ± 1 % |

**5.1.5 Calibration.** Prior to commencement of RCC production, the Contractor shall carry out a complete and comprehensive calibration of the plant in accordance with the manufacturer's recommended procedures. The calibration will be witnessed and approved by the Engineer. All scales, containers and other items necessary to complete the calibration shall be provided by the Contractor. After completion of the initial calibration daily yield checks shall be carried out. A complete recalibration shall be carried out as and when directed by the Engineer.

**5.1.6 Pavers.** Pavers shall be of the self-propelled type, specifically designed for RCC paving. Pavers shall be equipped with dual tamping bars and high density vibrating screeds capable of placing the RCC mix to at least 90% of required density. The paver shall be of suitable mass and stability so as to spread and finish the concrete to the indicated thickness, smoothness and surface texture requirements. The paver shall produce a finished surface conforming to smoothness and surface tolerance requirements specified herein. The paver shall confine edges of

lanes to true lines without use of stationary side forms and shall place the concrete to the required thickness free from segregation.

Each side of the paver shall be equipped with interchangeable side forms (shoes) which will form the edge of the pavement lane either vertically or 15 degrees from vertical. Pavers shall be designed to operate forward at variable speeds and in reverse. The paver shall automatically control both line and grade by means of electronic controls operating from stationary stringline or, as appropriate, short skis riding on a paved lane. Laser control devices may be used in lieu of a stringline provided the entire process is approved. Electronic controls shall be used to control grade on both sides of the paver.

## 5.1.7 Rollers

**5.1.7.1 Vibratory Rollers.** Vibratory rollers shall be self-propelled, doubled drummed, steel-wheeled vibratory rollers having an average operating weight of at least 2680 kg per lineal metre of drum. The rollers shall transmit a dynamic impact to the surface through the drums by means of revolving weights, eccentric shafts, or other equivalent methods. The roller shall have a vibrating frequency of at least 1500 cycles per minute. The amplitude shall be between 0.4 mm and 1.0 mm at the operating frequency used. Controls shall permit ready variation of the amplitude at a minimum of two settings over at least 50% of the above range. The roller drum shall be between 1200 and 1700 mm in diameter and 1600 to 2440 mm in width. The roller shall be operated at speeds not exceeding 2.4 km per hour. Within the range of the operational capability of the equipment, the Engineer may direct or allow variations with the specified range to the frequency, amplitude, and speed of operation which result in the required density and satisfactory surface texture at the fastest production rate. At least one self-propelled vibratory roller, in good operating condition and meeting these requirements, shall be used full time for each paver used full time. The roller shall be equipped with some means of keeping the drums damp during operation. Each drum shall be equipped with an operating scraper and pad. Any rollers which pick up material from the surface of the pavement shall be adjusted, modified, or replaced.

**5.1.7.2 Rubber-Tired Roller.** Rubber-tired rollers shall have smooth tires, non-oscillating wheels, tire pressure between 350 kPa and 620 kPa, with a total load between 1350 and 2000 kg per wheel. The roller shall have two axles with at least three wheels per axle, offset so that front and back tires do not track in the same path. At least one rubber-tired roller, in good operating condition and meeting these requirements, shall be used full time for each paver used full time.



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**5.1.7.3 Finish Roller.** A smooth-wheeled tandem roller weighing 5 to 10 t shall be used as the finish roller. A vibratory roller having a minimum static mass of 10 t may also be used, without vibration, as a finish roller to remove surface blemishes.

**5.1.8 Other Compaction Equipment.** Light walk-behind, or similar sized vibratory rollers and mechanical tampers, shall be furnished for use in compaction areas inaccessible to the large rollers.

**5.1.9 Haul Trucks.** The trucks for hauling the RCC mix from the plant to the paver shall be of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

- Boxes with tight metal bottoms.
- Covers of sufficient size and weight to completely cover and protect the RCC mix.

A truck may be rejected at any time during the project if its box is not clean to the satisfaction of the Engineer.

**5.1.10 Other Equipment Requirements**

**5.1.10.1 Straightedge.** One, 3 m straightedge shall be provided for each paving spreader for testing the finished surface. Straightedges shall have handles to facilitate movement on the pavement.

**5.2 Placement**

**5.2.1 Placing Conditions.** Prior to the placement of RCC mixture, the base surface shall be thoroughly wetted and uniformly moist. All RCC shall be mixed, transported, placed and compacted within 60 minutes. The time limit may be increased or decreased, depending on ambient conditions of temperature and humidity as directed by the Engineer.

**5.2.2 Weather Conditions.** The RCC placement shall be discontinued when the air temperature reaches 5°C and is falling, and shall not be resumed until the temperature reaches 5°C and is rising.

When the maximum daily air temperature is likely to exceed 29°C, special precautions shall be taken. The aggregates and/or mixing water shall be cooled to keep the RCC mixture below 27°C during spreading.

No placement of RCC mixture is allowed during periods of precipitation unless otherwise approved by the Engineer.

When a combination of daily maximum temperatures and wind conditions may lead to surface moisture loss exceeding 1 kg per m<sup>2</sup> per hr. as defined by Appendix D, CSA-A23.1, the RCC operations shall be discontinued until appropriate measures have been taken.

**5.2.3 Spreading.** The RCC mix shall be spread to a sufficient depth that will produce the specified thickness when compacted and conform to the required cross-section and grade. The paver shall be operated in a manner that will prevent segregation and produce a smooth continuous surface without tearing, pulling or shoving. The length of RCC spread shall be limited to that which can be compacted and finished within the appropriate time limit under the prevailing air temperature, wind and other climatic conditions.

**5.2.4 Multi-pavers recommended.** Where possible, more than one paver shall be used in staggered formation to produce multiple mats construction with minimum use of cold joints.

**5.2.5 Placing Odd-shaped Areas.** In isolated instances involving very small odd-shaped areas where use of machine spreading is impractical, RCC shall be spread by hand. Spreading shall be in a manner to prevent segregation. Mixture shall be spread uniformly with shovels in a loose layer of thickness that, when compacted, will conform to density, grade, thickness, and surface texture requirements.

**5.2.6 Multi-lift Construction**

Not more than 60 minutes shall elapse between placement of lifts on multi-lift construction.

A separate paver shall be required for each lift.

**5.2.7 Water Control.** Placing shall be done in a pattern so that curing water from previous placements will not pose a run-off problem on the fresh RCC surface or on the base course.

**5.3 Compaction.** Compaction shall be accomplished by self-propelled vibratory steel wheel rollers and rubber-tired rollers. Rolling shall be continued until a wet field density of not less than 98% of the maximum wet density obtained by ASTM D 1557 is attained.

A rolling pattern shall be established that will achieve the required density with a minimum number of roller passes. During vibratory compaction, the roller shall not start or stop in vibratory mode. The stopping point of successive rolling passes shall be staggered to avoid forming a depression on the surface.

In multiple mat construction, a 300 mm to 450 mm edge strip shall be left uncompacted until the adjacent mat is placed, at which time both sides of the fresh joint can be compacted simultaneously.

**5.4 Joints**

**5.4.1 Fresh joint.** A fresh joint is made when adjoining RCC mats are placed and compacted within 60 minutes



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of each other, with the time adjusted depending on ambient conditions.

**5.4.2 Cold Joints.** Any planned or unplanned construction joints in the RCC pavement that do not qualify as fresh joints shall be considered cold joints. In these cases, the edge of the previously placed RCC pavement shall be carefully cut back to expose an even, compacted, vertical surface of the full thickness of the course without disturbance of the RCC pavement that is to remain in place. This shall be done with an approved saw cutter or other approved equipment. Uneven areas and raveling shall be corrected by hand operations. When necessary, the fresh RCC pavement mixture shall be hand finished at joints.

Immediately prior to placing fresh RCC pavement mixture against the vertical cold joint, the joint shall be prepared by first removing any loose or foreign material and then brushing on a thick layer of cement and water slurry mixed at a water/cement ratio not exceeding 0.40. The slurry shall be of the consistency necessary to fill and remain in the voids along the joint. The slurry shall be applied immediately ahead of the RCC placement.

**5.4.4 Multi-lift Construction.** The top layer shall be placed so that longitudinal joints in that layer will coincide with joints in the lower layers of the pavement. Transverse joints in the top layer shall coincide with transverse joints in the lower layers of the pavement.

**5.5 Curing**

**5.5.1 RCC without asphalt surfacing.** When curing an RCC surface without asphalt surfacing, one of the following curing methods shall be used.

**Water cure.** The RCC surface shall be kept continuously moist by the application of water by means approved by the Engineer for a minimum of seven days and until the RCC reaches a compressive strength of 20 MPa.

The mist or spray shall not be applied in a channelized or pressurized manner that in any way erodes the surface of the RCC pavement. Water trucks shall not be allowed to drop oil or other contaminants on the surface. If trucks must leave the pavement, the tires shall be washed free of dirt or other foreign material before returning to the pavement. The total weight of the trucks and design of the running gear shall be such that no cracking or other damage to the RCC pavement is caused.

**Curing compound.** A specified membrane forming curing compound meeting ASTM C 309 shall be applied in two applications at the manufacturers recommended rate of application. The second application shall be

sprayed at 90 degrees to the first application. If the curing compound is not applied immediately after completion of compaction, the RCC surface must be moist cured until the curing compound is applied.

**5.5.2 RCC with asphalt surface.** Commencing immediately after rolling is complete, the surface of the RCC pavement shall be kept continuously moist by means approved by the Engineer until the RCC is at least 24 hours old. After the required initial water curing, the RCC pavement shall be cured using the asphalt emulsion RS-1. Water curing must be extended if there is a delay in spraying the emulsion on the surface.

Asphalt Emulsion RS-1 shall be applied at a rate of 0.5 kg to 1.0 kg per m<sup>2</sup> as per Division 4, Section 1, Emulsified Asphalt.

Curing compounds shall not be used on RCC with an asphalt surface.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Quality Control.** The Contractor shall take all control measures required to construct the concrete pavement in accordance with the specifications.

**6.2 Quality Assurance.** The quality assurance procedure of the Department shall not be used to replace or augment the quality control by the contractor.

**6.3 Strength.** The flexural test will be the standard test for assessing the strength of the concrete. CSA-A23.2 will be used as the test procedure, however, the specimens must be consolidated by impact hammers because of the low moisture content. Compressive strength tests or splitting tensile tests of cylinders may also be used to assess the suitability and uniformity of the concrete provided that a correlation has been established with flexural strength. Similar to the flexural specimens, these specimens must be consolidated by impact hammer to the maximum density specified based on the laboratory mixture. All specimens must be cast in rigid steel molds. The measured values and correlated flexural results must be reported.

The frequency of tests for compressive strength shall be one set of three cylinders per 100 m<sup>3</sup> of concrete. The frequency of tests for flexural strength shall be as for the compressive strength. A flexural strength test is the average of the flexural strength of two beams tested at the same age.

The average compressive strength of all sets of three consecutive strength tests of cylinders, made and tested in accordance with CSA-A23.2-3C and CSA-A23.2-9C, shall not be less than that as previously defined.

**Division 4 Pavements****Section 18 Roller Compacted Concrete (WS)****6.4 Tolerances**

**6.4.1 Thickness.** The Contractor shall verify by measurement and quantity calculation that the compacted thickness complies with the design. The owner may, at his own expense, extract cores to verify the thickness of the pavement. A thickness deficiency shall not exist if the average thickness of all cores meets or exceeds the design thickness and if no individual core is less than 90% of the design thickness.

**6.4.2 Smoothness Testing.** The finished asphalt surface will be tested as specified in the Special Provisions for the contract or the Standard Specification.

**7.0 METHOD OF MEASUREMENT**

**7.1 Roller Compacted Concrete.** The quantity of RCC pavement shall be the area in square metres computed from the dimensions shown on the drawings or as revised by the Engineer.

**8.0 BASIS OF PAYMENT**

**8.1 Roller Compacted Concrete.** Payment for RCC will be at the tender bid price per square meter of concrete in place, to the lines and grades as specified by the Engineer. Payment shall be full compensation for the supply, handling, mixing, transportation, placing, compaction and curing of the RCC, and the supplying of all equipment, plant, labour, materials and incidentals necessary to complete the work. Payment for RCC shall also include crackfilling of the asphalt surface.

**8.2** Items such as roadway and drainage excavation, fine grading, granular materials, tack coat not used for curing purposes and asphalt concrete paving will be paid for separately at their contract unit prices.

**9.0 WARRANTY**

**9.1 Initial Acceptance of the Work.** Upon completion of the project, the Contractor and the Project Engineer shall within five days jointly evaluate the finished surface for initial acceptance. Upon acceptance, the Project Engineer will issue in writing to the Contractor initial acceptance of the work indicating the date of acceptance and will submit the final estimate to release payment for all work completed including hold back. A one year maintenance period will begin on the RCC pavement from this date.

**9.2 Maintenance.** During this period, any failure in the final surface attributed to failure in the RCC, including but not limited to segregation, cracking, surface deformation, delamination and debonding shall be

repaired or reconstructed at the contractor's expense to the satisfaction of the Engineer. The cost of materials, haul and all other related work including traffic control required for repair or reconstruction of unacceptable areas shall be borne by the Contractor.

**9.3 Final Acceptance.** The Department or its representatives, and the Contractor will meet and inspect the finished surface one year after the date of initial acceptance of the work.

All areas that have failed as a result of the RCC pavement shall be repaired at the Contractor's expense at no cost to the Department. Based on the aforementioned regarding failure, if the Contractor and the Department do not agree on what areas are failed, the Department's decision shall be final.

The final acceptance of the original RCC surface by the Department shall relieve the Contractor from all maintenance responsibility with respect to the original RCC surface, however, the contractor shall be held responsible to maintain repaired areas for a period of 12 months after repairs are made.

**9.4 Liability.** During the period of construction and the one year maintenance period the Contractor shall be responsible for processing any and all claims for property damage and/or bodily injury caused by the failure of the RCC surfacing including, but not limited to, motor vehicle or pedestrians. The Contractor shall be responsible for the payment of all property damage and bodily injury claims and agrees to save and hold harmless the Department from all such claims as set out in Division 1 Section 4 Subsection 26 of these specifications. Claims not handled by the Contractor or his representative efficiently or expediently will be settled by the Department and the costs recovered from the Contractor.

**9.5 Security Deposit.** Notwithstanding anything to the contrary, as stated in Division 1, Section 3 Subsection 6 of these specifications, the security deposit for this contract will be held and retained by the Minister until the maintenance period has expired. The security deposit will be held to ensure that sufficient funds will be available to the Department in the event of non-performance by the Contractor. The Contractor is responsible for all costs including the materials and haul and for the repair of all failures and damages resulting from negligence or faulty workmanship by the Contractor that adversely affects the integrity of the RCC which occurs, and is evident prior to, the expiration of the one year maintenance period. The amount of security deposit shall be 10% of the tender value or as specified in the Special Provisions.



## Division 5 Structures

## Section 1 Piles

## SECTION 1 - PILES

## 1.0 DESCRIPTION

This section details the supply, delivery, handling, storing and driving of timber piles, steel H-piles and steel sheet piles. In all cases piles shall be of the type and size as indicated on the plans and shall be driven in the location(s), to the lines and grades and to the depths as indicated on the plans or as otherwise directed by the Engineer.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- CSA-056-M, Round Wood Piles
- CSA-080-M, Wood Preservation
- CSA-G40.21-M 300W, Structural Quality Steels
- ASTM A 328, Steel Sheet Piling
- ASTM D 1143, Method of Testing Piles Under Static Axial Compressive Load
- National Building Code of Canada
- CSA-W47.1, Certification of Company for the Fusion Welding of Steel Structures
- CSA-W59-M, Welded Steel Construction

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Timber Piles.** The Contractor shall supply certification of conformance with CSA-056-M and CSA-080-M.

**3.2 Steel Piles.** The Contractor shall supply mill certificates for H-Piles and Sheet Piles.

**3.2.1 Welding Procedure.** The Contractor shall supply the welding procedure for Steel H-Pile Splices.

## 4.0 MATERIALS

**4.1 Timber Piles.** All timber piles shall conform to CSA 056 M and shall be cut from live, sound and solid trees, preferably when the sap is down. They shall contain no unsound knots. Sound knots will be permitted provided the diameter of the knot does not exceed 100 mm or 30% of the diameter of the pile at the point where it occurs. Any defect or combination of defects which will impair the strength of the pile more than the maximum allowable knot, shall not be permitted. All knots shall be trimmed close to the body of the pile. The butts shall be sawed square and the tips shall be tapered to a point not less than 100 mm in

diameter unless otherwise directed by the Engineer. Unless otherwise specified, all piles shall be peeled by

removing all the rough bark and at least 80% of the inner bark. No strip of the inner bark remaining on the stick shall be over 20 mm wide or over 200 mm long, and there shall be at least 25 mm of clean wood surface between any two such strips. Not less than 80% of the surface on any circumference shall be clean wood. In untreated piling for use in exposed work, the diameter of the heartwood shall be not less than 80% of the required diameter of the pile.

Piles shall be cut above the ground swell and shall taper from butt to tip. A line drawn from the center of the tip to the center of the butt shall not fall outside of the center of the pile at any point more than 1% of the length of the pile. Piles shall be treated according to CSA-080-M.

Round piles shall have a diameter at the tip and butt after peeling, as stipulated in CSA-056-M.

**4.2 Steel Piles.** All piles shall be new material, straight and in accordance with CSA-G40.21-M 300W for steel H-piles and ASTM A 328 for steel sheet piles. The length, size, and type of piles shall be as shown on the plans or as approved by the Engineer.

## 5.0 CONSTRUCTION METHODS

## 5.1 Timber Piles

**5.1.1 General.** In general, the penetration for any pile shall be not less than 3 m in hard material, and not less than 30% the length of the pile nor less than 6 m in soft material. For foundation work, piling used to penetrate a very soft upper stratum overlying a hard stratum, shall penetrate the hard stratum a sufficient distance to rigidly fix the ends.

**5.1.2 Equipment.** All equipment for pile driving shall be subject to the approval of the Engineer. Timber piles shall be driven with a gravity hammer or diesel hammer. Gravity hammers shall weigh not less than 907 kg. The height of fall shall be so regulated as to avoid injury to the pile and shall in no case exceed 5 m. Pile driver leads shall be constructed in such a manner as to afford freedom of movement to the hammer and shall be held in position by guys or stiff braces to insure support to the pile during driving. The leads shall preferably be of sufficient length so that the use of a follower will not be necessary.



**Division 5 Structures****Section 1 Piles**

The driving of piling with followers shall be avoided, if practicable, and shall be done only with the written approval of the Engineer. When followers are used one pile from every group of ten shall be a long pile driven without a follower, and shall be used as a test pile to determine the average bearing capacity of the group.

Water jets shall not be used unless approved in writing by the Engineer, in which case jetting shall be subjected to all such conditions as may be required or specified by the Engineer.

**5.1.3 Preparation for Driving.** Foundation piles shall not be driven until after the excavation is completed to 300 mm below final grade.

When necessary to avoid injury to the heads of piles, they shall be protected by caps of approved design and shall preferably have a rope or other suitable suction and timber shock block. Iron collars or bands shall be used on the heads of piles when necessary to protect against splitting or booming during driving. When necessary, the tips of the piles shall be shod with metal shoes of an approved design, the tips of the piles being carefully shaped to secure even and uniform bearing on the shoes.

The Engineer shall be given not less than 48 hours notice before driving of piling in any unit is started, in order that an inspector may be placed on the work. Piling shall be driven only when an inspector is present and payment will not be allowed for piling driven in violation of this provision.

**5.1.4 Driving of Piles.** Piles shall be driven with variation of not more than 5 mm per 250 mm from the vertical or from the batter line indicated, and with a deviation of not more than 150 mm from the position indicated on the plans at elevation of cutoff. Any piles which do not meet these requirements shall be drawn and redriven.

Any material forced up between the piles shall be removed to correct elevation before concrete is placed.

Piles shall be driven to the distance below cutoff elevation shown on the plans or as ordered, or shall be driven until the required bearing capacity is obtained. Piles driven with heads below the cutoff elevation shall be withdrawn and replaced by new and larger piles at the expense of the Contractor. Broken, split, misplaced, or otherwise unsatisfactory piles, shall be drawn and replaced by satisfactory piles if so ordered by the Engineer. All piles raised during the process of driving adjacent piles, shall be driven down again

without additional compensation, if required by the Engineer.

Full length piles shall always be used where practicable, and piles shall be spliced only with the written approval of the Engineer. If splices cannot be avoided, an approved method of splicing shall be used.

The tops of piles shall be sawed to a true plane as shown on the plans and at the cutoff elevation fixed by the Engineer, with a tolerance of not more than 25 mm.

The tops of treated piles shall after final cutoff, be treated, as directed by the Engineer, with at least 3 applications of a preservative as specified in CSA 080-M or until satisfactory penetration has been obtained, and the top shall then be covered if required, with 4.5 kg sheet lead of sufficient size to cover the top of the pile and to be bent around the sides of the pile not less than 100 mm below the top of the pile for its entire circumference. Lead pile caps shall be wired with at least 6 turns of strong wire and stapled with at least 24 staples and afterwards covered up with coal tar.

Holes bored in treated piles shall be treated as stipulated in CSA 080-M.

**5.1.5 Determination of Bearing Capacity.** The bearing capacity of piles shall be determined by actual loading tests conducted according to ASTM D 1143 by the Engineer. In the absence of loading tests, the allowable bearing capacity of piles shall be as noted in the Special Provisions or on the plans and shall be determined by the Hiley Pile Formula as detailed in the National Building Code of Canada, unless otherwise directed by the Engineer.

In case piling is to be driven by means other than a gravity hammer, the piles shall be driven to the penetration determined from the results of test piles driven by the gravity hammer, regardless of the bearing capacities computed from the air or diesel hammer formulas. Bearing capacities shall be computed from the applicable hammer formula. However, to serve as a check on the results being obtained, and in case of any discrepancy between the computed capacities, another pile shall be driven as directed by the Engineer.

In case water jets are used in connection with the driving, the bearing capacity shall be determined by the above formulae from the results of driving after the jets have been withdrawn.

When piles with bearing capacity less than 14 t are specified, and when the pay length necessary to secure



**Division 5 Structures****Section 1 Piles**

14 t capacity does not exceed the pay length required for the specified capacity by more than 10%, piles shall be driven to 14 t capacity if directed by the Engineer.

**5.1.6 Test Piles.** When required, the Contractor shall drive test piles or other extra piles at the locations designated by the Engineer. These piles shall be of such length as will accommodate any variation in soil conditions from that indicated on the plans or in the proposal.

When piles are to be driven by means other than a gravity hammer, test piles shall be driven with a gravity hammer to determine the penetration necessary to secure the required bearing capacity. Such test piles shall not be driven until excavation is completed to 300 mm below grade. Two or more such test piles shall be driven in each major substructure unit, and the number driven shall be as specified by the Engineer. They shall be driven in the locations directed by the Engineer. Additional test piles of this nature shall be driven at any time and in such locations as directed by the Engineer.

**5.1.7 List of Piles.** Prior to starting footing excavation, the Contractor shall drive such test piles as may be required at that time by the Engineer. The Engineer will then estimate the penetrations required and will make a list of piling lengths to be ordered, furnishing the Contractor with a copy of this list. The lengths given in the list shall be based on the lengths which are assumed to remain in the completed structure plus an allowance to provide for fresh heading, which allowance will not exceed 1200 mm unless a greater allowance shall be requested by the Contractor in writing. The Engineer will not order more than a portion of the piles on the list until piles in the first shipment shall have been driven and have demonstrated the accuracy of the list. The list may be revised for the remaining portion of the piles if found necessary or desirable.

**5.1.8 Handling.** The methods of handling and storing timber piles shall be such as to avoid damage to the piles. Treated piles shall be handled by rope slings. Cant-hooks or pike poles shall not be used. Cuts or breaks in the surface of treated piles shall be given 3 brush coats of preservative as specified in CSA 080-M.

**5.2 Steel Piles**

**5.2.1 Steel H-Piles.** Piles shall be driven with a single acting diesel hammer or other adequate for the purpose and subject to the Engineer's approval. They shall be driven to practical refusal. Practical refusal shall be as determined by the Engineer or as indicated on the plans and/or in the Special Provisions. Piles shall be

spliced, when necessary, to provide for full length from practical refusal to cutoff. If considered necessary by the Engineer, the hammer shall be equipped with a driving cap to suit the piling. After being driven to refusal, piles shall be cut off neatly to the grade required, as determined by the Engineer. Surplus piles and cut offs shall become the property of the Department and shall be stored as directed by the Engineer.

Piles damaged during handling, transporting, or driving shall be replaced by the Contractor at the Contractor's expense.

The tops of vertical piles shall be driven to within 100 mm of their exact position and to within 100 mm of plumb in their entire length. Batter piles when finally driven shall also be within 100 mm of their true position and to the slope called for within a slope tolerance of 25 mm in 1500 mm. Piles lying outside these tolerances shall be extracted and redriven at the Contractor's expense as directed by the Engineer.

**5.2.2 Steel Sheet Piles.** Piles shall be driven with a diesel hammer or others adequate for the purpose and subject to the Engineer's approval. They shall be driven to an elevation as shown on the plans or as approved by the Engineer. If considered necessary by the Engineer, the hammer shall be equipped with a driving cap to suit the piling. After being driven to the approved elevation, piles shall be cut off neatly and uniformly at the elevation indicated on the plans or as directed by the Engineer. All surplus piling and cut offs shall become the property of the Department and shall be stored as directed by the Engineer.

Piles damaged during handling, transporting, or driving shall be replaced by the Contractor at the Contractor's expense.

Piles shall be erected and driven true to alignment with the individual piles plumb in both directions at locations and to dimensions as shown on the plans. If necessary, they shall be pulled and redriven. Each pile shall be within 100 mm of its true position at all points above the ground line and also within 100 mm of plumb for its entire height.

The piling for each individual sheet pile structure is to be erected and driven around a false work supporting one or more templates. The Contractor shall prepare drawings showing the proposed method of supporting the piling during erection, driving, excavation, unwatering and concrete work, against any possible action of hydrostatic water pressure, wind, current or

**Division 5 Structures****Section 1 Piles**

ice during the construction period. These drawings shall be submitted to the Engineer for his approval in advance of any construction or the purchase of any material for this purpose. The Contractor shall be held responsible for any loss or damage which may occur to the sheet pile structure during construction, due to any cause whatsoever, and shall replace or repair the sheet pile structure entirely at their own cost. Timber shall not be permitted to remain in the finished work. All false work shall be completely removed, as directed, upon completion of the concrete work.

All piles of an individual sheet pile structure shall be set up before driving and then driven in steps, the distance being suitable to the piling and to the resistance being offered by the materials being penetrated. This distance shall not exceed 900 mm for moderate resistance and 1500 mm for easy driving as determined by the Engineer. Driving shall not be continued if difficulties are encountered. The piles adjoining the obstruction are to be driven first before returning to those offering difficulty. If they still cannot be driven, the obstruction shall be removed by suitable means. The Contractor shall provide holes on the piling for anchor bolts, reinforcing steel and handling and erecting the piles as required. Holes shall not be larger than absolutely necessary.

**5.2.3 Handling.** All steel piles shall be carefully handled upon delivery and shall be carefully and neatly stacked at or near the site of the work in a manner satisfactory to the Engineer. Piles damaged during handling or transportation shall be replaced by the Contractor at their own expense.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

**7.1 General.** A record will be kept by the Engineer or representative for each pile showing the following information:

- actual length in metres delivered to the job site
- length in meters before driving
- date driven
- position or location referenced to plan
- length in meters after driving (sound length if timber)
- penetration in millimetres under the last blows of the hammer
- lengths in meters cut off during and after driving (broken down into sound and unsound lengths if timber)
- final cut off elevation

**7.2 Steel Sheet Piling Delivered Driven.** The

quantity on which payment is based is the area remaining in place below the theoretical cut-off elevation. The area is calculated as the product of the average length of pile remaining in place (determined from driving records) below the theoretical cut-off elevation and the perimeter of the cofferdam at the inner flange line of the piling.

**7.3 Steel H-Piling Delivered.** The length for payment is the sum of the lengths delivered and as specified on the plans. In cases where piles are driven beyond the tip elevations shown on the plans, the quantity for payment may be increased if it is determined that the piling delivered to the site and as shown on the plans was not of sufficient length to complete the work.

**7.4 Driving Steel H-Piles/Timber Piling.** The quantity on which payment is based is the sum of the lengths of piles remaining in place (determined from the driving records) below the cut-off elevation shown on the plans.

**8.0 BASIS OF PAYMENT**

**8.1 Timber Piles.** Timber piles will be paid for at the contract unit bid price per metre of pile in place for Timber Piles for sound lengths of piles in the completed structure, which price shall include supply, storage, field treatment and preparation, placement and driving of piles, pile shoes, lead pile caps where required and the transportation of all such material to the job site and all equipment, plant, false work, centering, bracing, tools, labor and incidentals necessary to complete work. Where an allowance in excess of 1200 mm for fresh heading has been furnished by the Department at the request of the Contractor, such excess allowance in meters shall be deducted from the lengths of piling paid for under this item.

Piling shall be driven only when an inspector is present and payment will not be allowed for piling driven in violation of this provision.

All piles raised during the process of driving adjacent piles, shall be driven down again without additional compensation, if required by the Engineer.

Payment will not be made for unauthorized piles, unsatisfactory driven piles, portions of piles cut off, any piles not driven, or any other costs to the Contractor.

Test piles or other extra piles ordered driven by the Engineer, which do not form part of the completed structure will be paid for as above.

Pile Load Tests will be paid for at the contract unit bid

**Division 5 Structures****Section 1 Piles**

price for Pile Loading Tests which price shall include supply of all materials and all equipment, labor and incidentals necessary to conduct the tests to the satisfaction of the Engineer.

**8.2 Steel Piles Delivered.** Steel piles delivered will be paid for at the contract unit bid price per metre for Steel H-Piles Delivered and per square metre for Steel Sheet Piles Delivered which prices shall include the supply, delivery and handling of the piles on the job site, steel plates used to reinforce pile tips, pile caps, pile splices, and all equipment, plant, tools, labour, and incidentals necessary to complete the work to the satisfaction of the Engineer.

**8.3 Steel Piles Driven.** Steel piles driven in place in the finished work will be paid for at the contract unit bid price per metre for Steel H-Piles Driven and per square metre for Steel Sheet Piles Driven which prices shall include all handling and storing; falsework; placing; erecting; driving; cutting; supply, fabrication and fastening of splice plates; supply, fabrication, and fastening of reinforcing plates to the pile tips; supply, fabrication and fastening of steel pile caps and all

labour, material, plant, equipment, tools, and incidentals necessary to complete the work to the satisfaction of the Engineer. Corner sheet piles shall be considered as standard piles for payment.

Payment will not be made for unauthorized piles, unsatisfactory driven piles, portions of piles cut off, any piles not driven, or any related costs to the Contractor.

**8.4 Mobilization of Pile Driving Equipment.** Mobilization of pile driving equipment will be paid for at the contract lump sum bid price for Mobilization of Pile Driving Equipment which price shall include all materials, equipment, tools, labour and services necessary to transport the equipment to the job site, move the equipment around the job site, and transport the equipment from the job site upon completion of all pile driving.

No payment will be made prior to the start of any pile driving unless approval is received from the Engineer.

**9.0 WARRANTY**



## Division 5 Structures

## Section 2 Timber Structures

## SECTION 2 - TIMBER STRUCTURES

## 1.0 DESCRIPTION

This section details the supply of timber and the construction of timber bridges and timber cribs.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM A 307A, Carbon Steel Bolts and Studs, 60000 psi Tensile
- ASTM D 390, Coal Tar Creosote for the Preservative Treatment of Piles, Poles, and Timbers of Marine, Land and Fresh Water Use
- NLGA Standard Grading Rules for Canadian Lumber
- CSA-080-M, Wood Preservative
- CSA-B111, Spikes
- CSA-G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Timber.** All timber shall be graded and stamped to NLGA No. 1 Structural Eastern Hemlock, Western Hemlock or Douglas Fir species only. It shall be square sawn as shown on the plans or to the dimensions as directed by the Engineer.

All timber shall be given a plant pressure treatment in accordance with CSA-080-M.

**4.2 Hardware.** Hardware shall meet the following specifications:

- Machine bolts, lag bolts, drift bolts, anchor bolts, nuts, and round plate washers: to ASTM A 307A
- Spikes: to CSA-B111
- Hot dip galvanized hardware, bolts, nuts, washers and spikes: to CSA-G164-M with minimum zinc coating of 600 g/m<sup>2</sup>

All hardware shall be galvanized unless otherwise shown on the plans.

## 5.0 CONSTRUCTION METHODS

**5.1 Timber Bridges.** The bridge shall be built in

accordance with the plans or to the lines and grades as directed by the Engineer.

When additional framing is required at the job site, the new surfaces shall be satisfactorily treated with three brush coats of preservative as specified in CSA-080-M. No structure shall be commenced until the foundation upon which it is to rest has been approved by the Engineer. The transportation, storage, handling, and placement of timber shall be completed in a manner that does not damage the material.

Under marine conditions special treatment, conforming to CSA-080-M or ASTM D 390 shall be required.

**5.2 Timber Cribs.** Timber Cribs shall be constructed in accordance with the approved plans and specifications or as directed by the Engineer.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

The timber in any structure shall be measured by the cubic metres of timber in place.

## 8.0 BASIS OF PAYMENT

**8.1 Timber Structures.** Timber in structures will be paid for at the contract unit bid price per cubic metre of timber for Timber in Structures, which price shall include supply and placing of timber, treating and framing (when required) at the job site, supply of the treating compound, transportation of all such material to the job site and all labour, tools, equipment, and incidentals necessary to complete the work to the satisfaction of the Engineer. Foundation excavation, rock fill, gravels and water control will be paid for as separate items of work in accordance with other sections of the Standard Specifications.

**8.2 Hardware.** Hardware used in timber structures will be paid for at the contract unit bid price per kilogram for Miscellaneous Metal, which price shall include the supply and placing of nails, spikes, drift bolts, washers, iron, etc., and all labour, tools, equipment, transportation and incidentals necessary to complete the work to the satisfaction of the Engineer.

## 9.0 WARRANTY





## Division 5 Structures

## Section 3 Structural Steel

## SECTION 3 - STRUCTURAL STEEL

## 1.0 DESCRIPTION

This section details the supply, fabrication, surface preparation, shop painting and delivery of structural steel to the site. This section also applies to the complete erection of the structural steel and all field work in conjunction with erection including field painting, erection and removal of all falsework and site clean up.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ANSI/AASHTO/AWS, Specification D1.5 Bridge Welding Code and D1.1 Structural Welding Code-Steel
- ASTM A 242, Specification for High-Strength Low-Alloy Structural Steel
- ASTM A 325, Specification for High-Strength Bolts for Structural Steel Joints
- ASTM A 588, Specification for High-Strength Low-Alloy Structural Steel with 50 ksi Minimum Yield Point to 100 mm
- ASTM D 3359, Method for Measuring Adhesion by Test Tape
- ASTM D 4752, Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub
- CGSB 1-GP-12C, Standard Paint Colours, Parts 1 to 3
- CGSB 1-GP-171M, Coating, Inorganic Zinc
- CGSB 1-GP-180Ma, Coating, Polyurethane, Two-Package, General Purpose
- CSA W59-M, Welded Steel Construction
- CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures
- CSA W48 Series, Electrodes
- CSA-G40.20-M, General Requirements for Rolled or Welded Structural Quality Steel
- CSA-G40.21-M Structural Quality Steel
- CSA-S6, Design of Highway Bridges
- CSA-S6.1-M90, Commentary on CSA Standard S6, Design of Highway Bridges
- SSPC, (Steel Structure Painting Council), Steel Structures Painting Manuals - Volumes 1 and 2, "Good Painting Practice" and "Systems and Specifications"

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The order of priority for the documents of this specification shall be:

- Reviewed Shop Drawings

- Special Provisions
- Structural Steel Standard Specification

**3.1 Submissions.** One month prior to the start of fabrication, the Fabricator shall submit seven copies to the Department, of the following documents:

- Verification of CSA W47.1 certification
- Welding procedures to be used for the shop fabrication
- General outline of schedule for fabrication
- Should the Contractor change the schedule for fabrication, where practical, he shall provide 24 hour notice to the Department to allow for additional inspection personnel
- Shop Drawings

Prior to the start of welding, the Contractor shall submit to the Department:

- Material test reports for all materials
- Valid Canadian Welding Bureau certification for each welder and welding operator for the positions and processes intended

Prior to the start of coating operations, the Contractor shall submit Manufacturer's Specifications and product data sheets.

## 3.2 Shop Drawings

**3.2.1 Review.** Shop drawing review by the Designer is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Designer approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Fabricator submitting the shop drawings, and such review shall not relieve the Fabricator of the responsibility for meeting all requirements of the contract documents. The Contractor shall be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or construction and for the installation of the work.

**3.2.2 Details and Revisions.** Shop drawings shall show the following details:

- Clear and obvious notes of any proposed changes from contract drawings and Specifications
- Fabrication and erection dimensions
- Details to indicate construction arrangements of the parts and their connections, and interconnections with other work
- Materials, coating system and finishes
- Dimensions and dimensioned locations of chases, sleeves, cuts, and holes in structural members

Shop drawings which require extensive correction will

**Division 5 Structures****Section 3 Structural Steel**

be sent back to the Contractor for revisions and resubmission, otherwise shop drawings will be sent back with review comments only. Only drawings noted for revision require resubmission.

New details or information added to shop drawings after they have been finally reviewed shall be approved by the Department.

If shop practice dictates that revisions to approved drawings are required, drawings shall be revised and resubmitted.

**4.0 MATERIALS**

All materials shall be supplied in new condition by the Contractor.

**4.1 Structural Steel.** All structural steel, with the exception of rolled angle, channels, WT shapes and sole plates, shall meet the requirements of CSA G40.21M Grade 350WT - Category 2 or Grade 350AT - Category 2 as specified on the plans.

All rolled angle shapes, sole plates and pintle assemblies shall conform to CSA G40.21M Grade 350A or ASTM A588.

**4.2 Shear Stud Connectors.** Shear stud connectors shall comply with CSA W59-M, Section 5. Acceptable studs are produced by Nelson Stud Welding or Continental Studwelding Limited.

**4.3 Anchor Bolts.** Anchor bolts shall conform to CSA G40.21M, Grade 300W and shall be hot dip galvanized.

**4.4 Bolts, Nuts and Washers.** Bolts, nuts and washers shall conform to ASTM A325M, Type 1.

**4.5 Coatings.** The Contractor shall submit, prior to fabrication, complete technical data provided by the coating manufacturer relating to all coating products to be used. The Department reserves the right to reject any coatings that it deems unsuitable. All coating products to be used shall be first line products. All coatings shall be packaged in two separate containers. Each container shall bear a label on which shall be clearly indicated the name of the Manufacturer or brand name of the coating, the lot number and date of manufacture.

**4.5.1 Prime Coat.** The prime coat shall conform to the requirements of SSPC-Paint 20 and CGSB Specification 1-GP-171M. This coat shall be a two-component self curing inorganic zinc rich ethyl silicate primer, colour grey. The percentage zinc in the dry film shall be  $85\% \pm 2\%$ .

**4.5.2 Intermediate Coat.** The intermediate coat shall be a high build, modified aluminum epoxy mastic. The epoxy-bitumen shall be designed as a one-coat high-build complete protective system. This coating shall be a two-component epoxy-mastic with the primary pigment being leafed aluminum colour. Secondary pigments shall be of rust inhibiting and adhesion promoting types. The vehicle shall be of the epoxy type modified with a bitumen oil and shall not contain coal tar. The minimum theoretical solids by volume content of the mixed material shall be 85% (ASTM D2697 Modified). The curing agent shall have suitable insensitivity to moisture to allow trouble-free application during normal humidity conditions.

**4.5.3 Top Coat.** The top coat shall conform to the requirements of SSPC-PS Guide 17.00 and CGSB Specification 1-GP-180Ma. This coat shall be a two component, high build, aliphatic polyurethane. The minimum theoretical solids by volume content of the mixed material shall be 57 % (ASTM D2697 Modified). The top coat shall be green in colour as per 503-105 of CGSB 1-GP-12C.

**4.6 Welding Electrodes and Filler Metal.** Welding electrodes shall conform to CSA W48.3, W48.4, W48.5 and W48.6. Filler metal shall be in accordance with Table 5-1, "Filler Requirements for Exposed Bare Applications of CAN3-G40.21-M 350A, 350AT, 400AT and ASTM A242 and A588 Steels" of the CSA W59 Specification.

Deposited weld metals in full penetration welds are required to have a minimum Charpy Impact Energy of 27 Joules at -30°C in accordance with Appendix A of CSA-S6. Certification shall be provided by the Contractor at no cost to the Department.

**4.7 Blast Media.** Blast media shall be capable of achieving the desired cleanliness and surface profile. The blast media shall contain no more than 1% by weight of water soluble solids. There shall be less than 10 ppm oil in the abrasive and no trace of salts or toxic materials. When cleaning by air blasting with sand abrasives, adequate separators and traps shall be provided to remove detrimental amounts of water and oil from the compressed air before it reaches the nozzle.

**5.0 CONSTRUCTION METHODS**

**5.1 Fabrication.** Fabrication shall not commence prior to the review of shop drawings by the Engineer or the Department's representative. Any fabrication done without the reviewed shop drawings may be rejected. All steel fabrication shall be done in accordance with CSA W59 and in accordance with the reviewed shop drawings.

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**5.2 Workmanship.** Workmanship and finish shall be of the best modern general practice in the bridge fabrication and construction industry. Shearing, flame cutting and planing shall be done carefully and accurately. Particular attention shall be paid to the neatness and uniformity of finish of all parts of the work exposed to view.

**5.3 Welding.** The steel Fabricator shall be a member in good standing of the Canadian Institute of Steel Construction.

All welding shall be performed by companies certified by the Canadian Welding Bureau (CWB) in accordance with the requirements of CSA W47.1 Division 1. The company shall have the organization, personnel, welding procedures and equipment required to produce satisfactory welds and weldments consistent with good bridge engineering practices.

Except with the express consent of the Design Engineer, there shall be no temporary welds in primary tension members nor in tension flanges of beams or girders.

The tolerances for fabrication shall be as detailed in CSA W59 or other applicable specifications. For tolerances not specified, the tolerance shall be 3 mm or one half the material thickness, whichever is smaller.

**5.4 Assembly.** In the event that the Department's representative is not present at the fabrication facility the Contractor shall provide 24 hours notice to the Department's representative to allow for the witnessing and verification of the final camber/sweep. Bolted girder splices shall be trial assembled prior to shipment. Trial assembly shall be witnessed by the Department or it's representative.

**5.5 Protective Coating System**

**5.5.1 General.** All coating operations shall be carried out in accordance with this specification. In the case of omission from this specification the work shall conform to the requirements of the SSPC Systems and Specifications, Steel Structures Painting Manual, Volume 2.

All steel surfaces shall be coated unless otherwise directed. The only surfaces that shall not be coated are those items imbedded in concrete. Faying surfaces shall be prime coated only.

Application of all coatings shall be carried out in strict accordance with the Manufacturer's Specifications and recommendations.

All coatings shall be supplied by the same Manufacturer

and shall be completely compatible with each other.

**5.5.2 Surface Preparation.** All deposits of oil or greasy contamination shall be removed in accordance with SSPC-SP 1, "Solvent Cleaning" before commencing other surface preparation.

All weld splatter, slag, rust, burrs, slivers etc. shall be removed prior to coating in accordance with the requirements of SSPC-SP 2 "Hand Tool Cleaning" and/or SSPC-SP 3 "Power Tool Cleaning". This work shall be approved by the Engineer or their representative prior to blast cleaning.

Corners and edges of flanges, stiffeners and bracing shall be broken on items which are to be painted.

All steel surfaces to be coated shall be abrasive blast cleaned in accordance with the requirements of SSPC-SP 10, "Near-White Blast Cleaning".

All steel surfaces to be primed shall have a surface profile as recommended by the coating Manufacturer to achieve good adhesion.

**5.5.3 Primer Coat.** The inorganic zinc coating shall be applied to the metal surface with airless spray equipment or as recommended by the Manufacturer.

The inorganic zinc rich coating shall be applied in the shop to obtain an average dry film thickness of  $62.5 \mu\text{m} \pm 12.5 \mu\text{m}$ . The minimum allowable spot coating thickness reading shall be  $50 \mu\text{m}$ .

Any damage to the inorganic zinc rich coating resulting from shipping or erection shall be repaired prior to the application of the intermediate coat. Repairs shall utilize a compatible organic zinc rich epoxy applied in a manner recommended by the manufacturer for such operations. All such repairs shall be approved by the Engineer prior to the application of the intermediate coat.

Application conditions shall be as detailed by the Manufacturer.

**5.5.4 Intermediate Coat.** The two component, high build, modified aluminum epoxy mastic shall be applied over the inorganic zinc. All edges, corners, crevices, welds and bolts shall be stripe painted prior to the application of the intermediate coat. Such striping shall extend a minimum of 20 mm from the edge.

Prior to the application of the intermediate coat the cure of the inorganic zinc rich primer will be tested using ASTM D 4752, or by such methods as approved by the Engineer. A resistance rating of 4 or higher is required before the intermediate coat shall be applied or as

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approved by the Engineer.

The modified aluminum epoxy mastic intermediate coat shall be applied after erection. Application of the intermediate coat shall not be done at the site of fabrication unless approved by the Engineer. The intermediate coat shall be applied to obtain an average dry film thickness of  $125 \mu\text{m} \pm 25 \mu\text{m}$ . The minimum allowable spot coating thickness for this coat shall be  $100 \mu\text{m}$ .

The surfaces to be coated shall be free of contaminants before application of the intermediate coat. If contaminants are evident the affected areas shall be thoroughly cleaned in accordance with SSPC-SP 1, "Solvent Cleaning".

The colour of the intermediate coat shall be in contrast with the primer and topcoat.

Application conditions and curing time for the intermediate coat shall be as detailed by the Manufacturer.

**5.5.5 Topcoat.** The two component aliphatic polyurethane shall be applied over the high build aluminum epoxy mastic intermediate coat after erection. Application of the topcoat shall not be done at the site of fabrication unless approved by the Engineer. The topcoat shall be applied to obtain an average dry film thickness of  $100 \mu\text{m} \pm 25 \mu\text{m}$ . The minimum allowable spot coating thickness for this coat shall be  $75 \mu\text{m}$ .

The surfaces to be coated shall be free of contaminants before application of the topcoat coat. If contaminants are evident the affected areas shall be thoroughly cleaned in accordance with SSPC-SP 1, "Solvent Cleaning".

The colour of the topcoat shall be as per 503-501 of CGSB 1-GP-12C.

Application conditions shall be as detailed by the Manufacturer.

**5.6 Transportation, On-Site Storage and Erection.** Structural steel components shall be transported in such a manner so as to avoid development of fatigue cracks and deformation.

When the components are stored on the jobsite they shall be placed on timbers so that they do not make contact with the ground and are supported to avoid fatigue cracking, deformation or over stressing. They shall be stored in a location where they will not be subject to damage or surface contamination.

The Fabricator shall erect the whole of the fabricated structural steel work supplied under the contract. The Contractor shall supply all materials, tools, equipment, plant and labour necessary for the erection of the steelwork. The Fabricator shall erect the structural steel in accordance with the requirements of the AASHTO Specifications and CSA S6 specifications.

After the structural steel and associated bracing has been erected, and before deck forming is started, elevations of the tops of the girders will be determined by the Department at intervals specified by the Engineer.

It shall be the Contractor's responsibility to provide, at their own expense, an experienced steel worker to do the necessary survey rod work involved in obtaining the elevations.

The in-place elevations will be reviewed by Department staff and approval given to the Contractor by the Engineer before the deck forming is commenced.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

Inspection by the Engineer, or representative, may extend to all or any part of the works and to the preparation, fabrication or manufacture of any of the materials. Any work done or materials used without supervision or inspection may be ordered to be removed and replaced at the Contractor's expense.

**6.1 Welding.** The acceptance criteria for all inspections shall be based on CSA W 59, Section 12, Dynamic Steel Structures. All welds shall be visually inspected.

All full penetration welds, except those specified in webs, shall be 100% inspected by Radiographic or Ultrasonic methods. When welds are tested by the Ultrasonic method, spot Radiography shall be performed on 10% of those welds tested.

All full penetration welds in webs shall be inspected by Radiographic or Ultrasonic methods for at least 25% of the weld length. The inspection shall be performed nearest the tension flange. If defects are identified, additional inspections shall be done to determine the extent of these defects.

All fillet welds in flange to web connections shall be 100% inspected by Magnetic Particle Inspection.

All remaining fillet welds shall be randomly inspected by Magnetic Particle Inspection. Random inspections shall cover a minimum of 25% of the total weld area. Inspections shall be concentrated at weld terminations.



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**6.2 Coatings.** Coating inspection shall be performed in accordance with the procedures outlined in SSPC Manual, Volume 1, Chapter 6, "Inspection".

Profile measurements shall be made on a random basis by use of replica tape and spring micrometer or by micrometer depth gauge.

Dry film coating thickness readings shall be performed in accordance with SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages".

When necessary, the testing of ambient and surface temperature and humidity shall be done by thermometer, surface thermometer, and psychrometer with recognized psychrometric tables.

Destructive testing may be required where inadequate adhesion of the coating(s) is suspected. Adhesion testing shall be done in accordance with ASTM D 3359. Adhesion shall be considered acceptable, depending upon the dry film coating thickness, if it meets the requirements of classifications 5A, 4A, 5B, or 4B. Coatings damaged as the result of destructive testing shall be repaired at the expense of the Fabricator if the adhesion does not meet the acceptance criteria. Should the coating meet the adhesion requirements repairs will be paid for by the Department at a rate agreed to by the Department and the Fabricator. Repair procedures and materials shall be approved by the Engineer prior to application.

**6.3 Dimensions.** The dimensions of all structural members including the overall girder, girder splices, bracing and diaphragms shall be inspected for compliance with the approved shop drawings. In addition any camber specified for girders shall be verified.

**7.0 METHOD OF MEASUREMENT**

The preparation of all shop drawings, erection drawings, welding procedures, calculations, etc., shall not be measured for payment but shall be considered as incidental to the work.

The furnishing of certified test reports for the qualification of paint manufacturers, if deemed necessary by the Engineer, shall not be measured for payment but shall be considered as incidental to the work.

The supply of any additional structural steel not shown on the drawings, deemed necessary for the erection condition, including falsework and guys that may be required to maintain stability, shall not be measured for payment but shall be considered as incidental to the work.

**8.0 BASIS OF PAYMENT**

Structural steel will be paid for at the contract lump sum bid price for Structural Steel which price shall include all labour, equipment and materials required for the supply, fabrication, surface preparation, coating, loading, shipping, delivery and erection of the complete steel superstructure in accordance with the plans and Specifications.

The cost of additional inspection and testing made necessary by the Contractor's work not meeting these specifications shall be the responsibility of the Contractor.

The Contractor may be granted partial progress payments as determined by the Engineer for this item on the basis of committed materials delivered to the Fabricator's shop and for fabrication satisfactorily completed.

The Engineer's decision as to the value of the work completed for partial progress payment shall be final. Upon payment, the material (before and after fabrication) for which payment has been made shall become the property of the Department with the Contractor assuming full responsibility for safe storage and transport to the erection site.

**9.0 WARRANTY**



## Division 5 Structures

## Section 4 Miscellaneous Metal

## SECTION 4 - MISCELLANEOUS METAL

## 1.0 DESCRIPTION

This section details the supply, fabrication and erection of all miscellaneous metal, including deck drains, not specifically referred to elsewhere in these specifications or Special Provisions, as shown on the plans or as directed by the Engineer.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- CSA-G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Miscellaneous metal shall include the following: anchors, bolts, nuts, bearing plates, expansion plates, metal conduits, scuppers, pipes, drains, lead, and similar metal items not specifically referred to elsewhere in these specifications or Special Provisions, regardless of the type of metal specified.

All miscellaneous metal shall be subject to the approval of the Engineer as to their type, make, and finish; and this item shall include all necessary shop and field work such as machining, drilling, reaming, cutting, welding, and any other work that may be required to be done on these materials, subject to the approval of the Engineer. All material shall be new materials.

All items shall be galvanized in accordance with CSA - G164-M. A minimum of 763 g/m<sup>2</sup> of zinc is required on the surface of all galvanized sections.

## 5.0 CONSTRUCTION METHODS

All anchors, whether for the main structure or for railings, shall be carefully and accurately set as shown on the plans or as directed by the Engineer. In case anchor bolts have to be set or reset in concrete, holes shall be drilled in the concrete and anchor bolts placed and secured in place with portland cement grout, or by other means, where and as directed by the Engineer.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

All miscellaneous metal shall be inspected and approved by the Engineer before being used.

## 7.0 METHOD OF MEASUREMENT

The weight of miscellaneous metal shall be the total computed weight in kilograms of the various parts and to the finished dimensions as shown on the plans or as directed by the Engineer in writing. Deductions shall be made for all cuts, copes and open holes. No allowance in weight shall be made for galvanizing, painting or for welding rods and any metal used temporarily and not forming part of the completed structure. The weight of rolled shapes and of plates up to and including 900 mm in width shall be computed on the basis of the nominal weight and dimensions.

The weights of all other miscellaneous metal shall be based on the following table:

Table 5.4.1 - Miscellaneous Metal

| Metal            | Unit Weight (kg/m <sup>3</sup> ) |
|------------------|----------------------------------|
| Aluminum         | 2755                             |
| Brass, Bronze    | 8490                             |
| Copper           | 8890                             |
| Iron, cast       | 7208                             |
| Iron, wrought    | 7800                             |
| Lead             | 11 373                           |
| Steel, all kinds | 7850                             |
| Tin              | 7290                             |
| Zinc             | 7208                             |

## 8.0 BASIS OF PAYMENT

Miscellaneous metal will be paid for at the contract unit bid price per kilogram for Miscellaneous Metal complete in place which price shall include supply and placing of all materials, and all equipment, tools, labour, shop, transportation, and incidentals necessary to complete the work to the satisfaction of the Engineer.

## 9.0 WARRANTY



## Division 5 Structures

## Section 5 Reinforcing Steel

## SECTION 5 - REINFORCING STEEL

## 1.0 DESCRIPTION

This section details the supply, delivery and placing of uncoated and epoxy coated reinforcing steel as shown on the plans or as directed by the Engineer.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM A 615, Deformed and Plain Billet Steel Bars for Concrete Reinforcement
- ASTM A 616, Rail Steel Deformed and Plain Bars for Concrete Reinforcement
- ASTM A 617, Axle Steel Deformed and Plain Bars for Concrete Reinforcement
- ASTM A 706, Low Alloy Steel Deformed Bars for Concrete Reinforcement
- ASTM A 775, Epoxy Coated Reinforcing Steel Bars
- ASTM D 3963/D3963M, Epoxy Coated Reinforcing Steel
- CSA-G30.18M, Billet Steel Bars for Concrete Reinforcement, Grade 400
- CSA-A23.3, Design of Concrete Structures

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Uncoated Reinforcing Steel.** All reinforcing steel shall be deformed and shall conform to CSA-G30.18M Grade 400 or ASTM A 615, A 616, A 617 or A 706.

**4.2 Epoxy Coated Reinforcing Steel.** Epoxy coated reinforcing steel shall conform to ASTM D 3963 and A 775.

**4.3 Coating Material.** The coating material to be used in the repair of Epoxy Coated Reinforcing Steel shall conform to ASTM Annex A1 in D 3963.

## 5.0 CONSTRUCTION METHODS

**5.1 General.** All steel reinforcing bars shall have the necessary net sectional area, and shall be cut to the exact lengths, and bent cold to the exact forms and dimensions, shown on the approved plans, or otherwise required, before being placed in position. Bending shall be accurately done, in a bending machine and no welding or heating of any bars shall be allowed, except with written approval from the Engineer. All stirrups and hoops shall accurately fit the rods, and all bends shall be taken out of bars to be used as straight members.

All reinforcing bars shall be placed and held rigidly in the exact positions in the forms as shown on the approved plans, or otherwise required, and there shall be no displacement of the same by the placing and tamping of the concrete. Adjusting or moving the bars, while the concrete is being placed, shall not be permitted, unless specified on the plans. Concrete protection required for reinforcing steel shall be in accordance with the plans, Department Specifications, or CSA-A23.3. All bars shall be tied and properly braced to prevent displacement. No concrete shall be placed until the steel reinforcement, after being cleaned and placed in position, has been examined and approved by the Engineer or representative.

**5.2 Tying Uncoated Reinforcing Steel.** For lapping uncoated reinforcing steel bars at the joints and intersections, an ample supply of annealed wire at least 1.5 mm in diameter shall be provided. Proper cutting pliers shall be used and the bending and tying of the wires done as neatly as possible.

**5.3 Epoxy Coated Reinforcing Steel.** All tie-wires, chairs and bar supports and other material used for the installation of the coated reinforcing bars shall be either coated with powdered epoxy resin or acceptable material at all contact points and within 50 mm of exposed faces or be of an acceptable non-metallic material.

All bar ends shall be coated with material meeting the requirements of these specifications before rusting occurs and before shipment to the job site.

Splices shall only be provided where shown on the plans. No other splices shall be permitted without the written approval of the Engineer.

The delivery of the bars shall be coordinated with the scheduled bar placement. The manufacturer shall pack and transport the coated bars and fabricated assemblies to minimize damage to the epoxy coating. Upon delivery, the bars shall be handled and supported to prevent excessive distortion.

The bars shall be transported and handled with care. Coated bars shall be handled with equipment with padded contact areas. Bundling bands shall be padded, or suitable banding used to prevent damage to the coating. Bundles of coated bars shall be lifted with a strong back, spreader bar, multiple supports, or a platform bridge to prevent bar to bar abrasion from sags in the bundles. The coated steel reinforcing bars or bundles shall not be dropped or dragged.

The bars shall be off-loaded and stored as close as



**Division 5 Structures****Section 5 Reinforcing Steel**

possible to the area where they will be placed so that the coated bars can be hoisted to the area of placement to minimize rehandling. The bars and assemblies shall be stored so that they are not distorted.

Unprotected on-site storage shall not exceed 30 days and total on-site storage time shall not exceed 120 days. When protection is required, bars shall be covered with opaque polyethylene sheeting or other equivalent protective material. For stacked bundles, the protective covering shall be draped around the perimeter of the stack. The covering shall be adequately secured, with provision for sufficient air circulation around the bars to minimize condensation under the protective covering. The identification tags on the bars and assemblies shall be protected. The date the bars are received at the jobsite and the date the coated bars are covered shall be recorded on the identification tags.

The bars shall be stored clear of ground on timbers or other suitable protective cribbing spaced to prevent sags in the bundles. Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.

When the exposure time of coated bars installed in the structure is expected to exceed or does exceed 30 days, including bars partially embedded in concrete, the coated bars shall be protected from the elements by covering with opaque polyethylene sheeting or other equivalent protective material. The protection shall be adequately supported and secured in place. The protection shall be maintained until its removal is required for preparation for subsequent concrete placement.

Metal bar supports shall be coated with a non-corrosive, non-conductive material such as epoxy, nylon, or PVC. Galvanized bar supports shall not be used. Plastic bar supports or pre-cast concrete blocks may be used but if imbedded wires are used the wires shall be epoxy or vinyl coated. Support steel; e.g., spacers, used with coated bars shall be coated with a non-conductive material such as epoxy, nylon, or PVC. Reinforcing bars used as bar supports shall be epoxy coated. Tie wire shall be black-annealed wire, 16.5 gauge or heavier, coated to minimize damage to the bar coating.

If field cutting is required, hydraulically powered cutters or friction cutting tools shall be used. No flame cutting shall be used. All cut ends shall be repaired immediately to the satisfaction of the Engineer.

Bars with coating damage greater than 1% of the surface area in any one metre length of bar shall be rejected. Bars with coating damage of 1% or less shall have all damaged areas of the coating repaired.

Repairs to damaged epoxy coating shall comply with ASTM D3963/D3963M. The coating in repair areas shall have a minimum thickness of 7 mils.

Repairs shall not be performed when the coated bar or ambient air temperature is 5°C or less, or when moisture is present on the bar.

Patching material shall not be applied if precipitation is expected within 4 hours of the procedure, as the coating may wash off. If precipitation does occur within 4 hours, the Engineer shall make a determination as to whether the material as applied is acceptable or must be replaced.

Patching material shall be applied in strict accordance with the written instructions furnished by the approved patching material manufacturer.

After epoxy coated reinforcing steel installation, walking on the coated bars shall be avoided. The placement of mobile equipment shall be planned to avoid damage to the bars.

If the placed coated bars have been exposed to salt spray or road salts, the bars shall be rinsed with fresh water to remove any chloride contamination prior to placing concrete.

Care shall be taken to avoid dropping any tools or construction material on the rebar. Properly supported runways shall be set up for concrete buggies, pumping hoses, etc. Rubber or non-metallic vibrator heads shall be used when compacting the concrete.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

All plants producing Epoxy Coated Reinforcing steel shall have CRSI Plant Certification.

After all rebar is in place a final inspection shall be made to locate any damage or deficiencies. All visible damage or any deficiencies shall be repaired to the satisfaction of the Engineer before the concrete is poured.

**7.0 METHOD OF MEASUREMENT**

Delivery and placement of all Reinforcing Steel shall be measured for payment by the kilogram. The total mass is to be determined based on the actual length of bar accepted for payment and the mass per unit of length as stated in CSA-G30.18M or ASTM A 615M.

**8.0 BASIS OF PAYMENT**

Reinforcing steel will be paid for at the contract unit bid

**Division 5 Structures****Section 5 Reinforcing Steel**

price per kilogram for:

- Uncoated Reinforcing Steel Delivered
- Epoxy Coated Reinforcing Steel Delivered
- Placing Uncoated Reinforcing Steel
- Placing Epoxy Coated Reinforcing Steel

which prices shall include all materials, transportation, equipment, plant, tools, labour and incidentals necessary to complete the job to the satisfaction of the Engineer. No allowance will be made for the clips, wire or other mechanical means for fastening the uncoated and epoxy coated reinforcing steel in place.

The Contractor shall be responsible for the reinforcing steel during transportation and after delivery to the job site until the complete structure has been accepted by the Engineer. The Department will not be liable for the replacement of any parts if such becomes necessary at any time during the contract.

**9.0 WARRANTY**



## Division 5 Structures

## Section 6 Steel Guard Rail Systems And Wooden Guide Posts

**SECTION 6 - STEEL GUARD RAIL SYSTEMS AND WOODEN GUIDE POSTS****1.0 DESCRIPTION**

This section details the supply, erection, removal and adjustment of galvanized steel guard rail systems, treated wooden guide posts and all related materials.

A guard rail system includes all rail elements, related hardware, reflectors, posts and blocks and is used to protect the motorist from a roadside hazard. Guide posts are used for shoulder delineation only.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM A 307, Specification for Carbon Steel Bolts and Studs 60,000 psi tensile
- CSA-080-M, Wood Preservation
- CSA-G40.21-M, Structural Quality Steels
- CSA-G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles
- CSA-M89.3, Field Treatment
- Drawings HS517.DWG to HS526.DWG.
- NLGA, National Lumber Grades Authority

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

The following document shall be submitted to the Engineer before any material is accepted for use in construction:

- Quality Control Inspection Document from the treated wood supplier indicating:
  - preservative treatment parameters
  - species verification
  - a cross reference of inspection reports with material supplied

**4.0 MATERIALS**

**4.1 Posts and Blocks.** The acceptable species for guard rail posts and guide posts and blocks shall be:

- Eastern hemlock
- Red Pine
- Mixed Hardwood (birch, maple, oak or ash)

The dimensions of guard rail posts shall be either 200 x 200 x 2100 mm or 150 x 200 x 2100 mm and blocks shall be 200 x 200 x 440 mm or 150 x 200 x 440 mm as shown on Drawing HS518 in Division 8 of these specifications.

The dimensions of wooden guide posts shall be 140 x 140 x 1800 mm. Guide posts shall extend 1000 mm into the ground below the finished grade.

Post delineators shall be supplied by the Department free of charge from the Truro Sign Shop and shall be installed as shown on Drawing HS518 in Division 8 of these specifications.

Physical properties of posts and blocks shall conform to Section 131b of the NLGA.

Preservative treatment of posts and blocks shall be by Water-borne Preservative Chromated Copper Arsenate (CCA) or creosote as specified in CSA-080-M Commodity Standards 080.14, Table 5.6.1.

Posts and blocks shall be bored as shown on plan HS518 in Division 8 of these specifications before treatment. Upon completion of treatment, all excess material shall be removed from the surface prior to shipping.

Treatment shall be completed in accordance with requirements of CSA-080-M. Requirements for penetration and retention shall be as illustrated in Table 5.6.1.

Table 5.6.1 - Treatment

| Treatment | Retention <sup>(1)</sup><br>(kg/m <sup>3</sup> ) | Penetration<br>(mm) |
|-----------|--------------------------------------------------|---------------------|
| CCA       | 6.4                                              | 13                  |
| Creosote  | 128                                              | 13                  |

<sup>(1)</sup> Minimum average net by assay according to end use and species

To maintain consistency throughout a project, only one type of treatment shall be accepted for any one section of a contract.

**4.2 Guard Rail Units**

**4.2.1 Beam.** The steel beam shall be in accordance with the cross-section and dimensions as shown on plan HS518 in Division 8 of these specifications. The rail shall be manufactured from base metal with a minimum thickness of 2.5 mm and conforming to CSA-G40.21M Grade 300. All rail and terminal elements shall be galvanized after fabrication in accordance with CSA-G164-M. All bolts, nuts and washers shall conform to ASTM A 307 and shall be hot dipped galvanized conforming to CSA-G164-M.

**4.2.2 Channel.** The steel channel shall be manufactured to the cross-section and dimensions as

**Division 5 Structures****Section 6 Steel Guard Rail Systems And Wooden Guide Posts**

shown on plan HS518 in Division 8 of these specifications. The channel shall be manufactured from base metal with a minimum thickness of 3.8 mm and conforming to CSA-G40.21-M Grade 300. All bolts, nuts and washers shall conform to ASTM A 307 and shall be hot dipped galvanized conforming to CSA - G164-M.

**5.0 CONSTRUCTION METHODS**

**5.1 Installation.** The Contractor shall erect Steel Guard Rail in accordance with the following plans located in Division 8 of these specifications:

- HS518 Guard Rail and Guide Post Details
- HS519 Guard Rail Post Details
- HS520 Steel Beam Guard Rail Installation Details
- HS521 Guard Rail Layout Bridge Approach
- HS522 Michigan Shoe Details
- HS523 Guard Rail Channel Details
- HS524 Guard Rail Protection of Bridge Piers
- HS525 Guard Rail Anchor Base on Concrete
- HS526 Guard Rail Protection of Sign Truss Structures
- HS527 Guard Rail Protection of Highway Signs

Additional posts shall be placed at the mid point of the first three lengths of guard rail adjacent to the ends of bridges and at the quarter points of the guard rail sections adjacent to the ends of bridges as shown on plan HS521 in Division 8 of these specifications. Also, blocks shall be installed on each post for the first five lengths of guard rail adjacent to the ends of bridges.

To maintain consistency throughout a project, only one size post and block shall be used on any one section of a contract. 200 x 200 x 440 mm blocks shall only be used with 200 x 200 x 2100 mm posts and 150 x 200 x 440 mm blocks shall only be used with 150 x 200 x 2100 mm posts.

In addition to being used to support steel guard rail sections, posts may be used alone for shoulder delineation. In both cases, posts shall be placed at such distance as to conform to the alignment of the road, or as directed by the Engineer. Post holes shall be dug and/or augured and posts set to the depth, horizontal lines, vertical lines and grades as shown on the plans. Care shall be exercised when installing posts to minimize disturbance to the shoulder. The backfill material shall be the same material that is excavated for the post and it shall be well compacted to the satisfaction of the Engineer.

Care shall be taken during the transport, treatment and handling of posts and blocks to prevent damage. Any damage occurring to the posts and blocks prior to delivery and during delivery and installation shall be repaired to the satisfaction of the Engineer and shall be

considered as incidental to construction for the purpose of payment.

No alterations to treated posts and blocks shall be permitted without the approval of the Engineer. Blocks shall not be manufactured from posts. Any exposed cuts as a result of alterations shall be treated as per CSA-M89.3.

The rail elements shall be erected to produce a smooth continuous rail paralleling the line and grade of the highway surface as directed by the Engineer. All rail elements shall be lapped in the direction of traffic.

**5.2 Removal/Adjustment/Repair.** Wooden Guide posts and steel guardrail systems shall be removed where and as directed by the Engineer and shall be stored for future use at the nearest Department Depot or where directed by the Engineer and to the satisfaction of the Engineer.

Steel guard rail systems shall be adjusted/repared according to the lines and grades as directed by the Engineer. This operation shall consist of removal or adjustment of the damaged or misaligned steel guardrail system components, discarding those that are damaged beyond repair, repairing those as required and replacing the necessary components with either repaired or new components as directed by the Engineer.

The Engineer will decide which guard rail system components are reusable and which are to be discarded.

Every effort shall be made to avoid damage to reusable guard rail system components during the removal operation, especially the galvanized surfaces. The use of heat to remove bolts and the cutting of rail sections and bolts shall not be permitted unless approved by the Engineer.

Any damage to galvanized surfaces as a result of the removal or repair operations shall be repaired by painting the damaged areas with two coats of paint approved by the Engineer and shall be considered as incidental to construction for the purpose of payment.

Damaged posts and blocks shall be treated as required according to CSA-M89.3.

To maintain consistency throughout a project, damaged posts and blocks shall be replaced with the same size posts and blocks in accordance with plan HS518.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

The contractor shall provide a quality control program



**Division 5 Structures****Section 6 Steel Guard Rail Systems And Wooden Guide Posts**

for posts and blocks. Contractors, at their own expense, shall hire a qualified firm acceptable to the Department to perform the required testing and inspection and provide all documentation as specified in Subsection 3.

The sampling and testing shall be as described in CAN/CSA-080-M89.3.

Quality control test results shall be submitted in conjunction with the delivery of the posts and blocks. Where the delivery takes place in periodic intervals, the quality control results for the lots delivered shall be provided.

Representatives of the Department shall have access to the lumber before and after treatment for the purpose of quality assurance testing. Any lot or charge which does not meet the specifications when tested as part of the quality assurance program may be rejected by the Department. In such cases duplicate samples will be obtained and analyzed. The results of the duplicate tests shall be considered final for the purposes of acceptance. Failure to meet the specification does not preclude the Contractor from re-treating the posts and blocks so as to meet specification requirements.

**7.0 METHOD OF MEASUREMENT**

**7.1 Guide Posts.** Wooden guide posts shall be measured for payment as one unit (each) for both installation or removal.

**7.2 Guard Rail Systems.** Steel guard rail systems shall be measured for payment in lineal metres based on the length of rail plus the length of end wings and any appurtenances. The value used in the calculations for the length of standard rail is 3.81 m, that is the distance between support holes. The length of a standard end wing to be used in the calculations is 0.54 m. When more than one rail and/or a channel section is placed between posts or removed, the length used in the calculations for payment is 3.81 m.

**8.0 BASIS OF PAYMENT**

**8.1 Guide Posts.** Wooden guide posts will be paid for at the appropriate contract unit bid price per post for:

- Installation of Wooden Guide Posts
- Removal of Wooden Guide Posts

which prices shall be full compensation for the transportation, handling and supply of treated wooden guide posts, digging and/or auguring of post holes, setting of posts, installing reflectors, backfilling and compacting, disposal of surplus material, removal of wooden guide posts, cleanup of the site and all equipment, plant, labor, quality control and any other incidentals necessary to complete the work to the satisfaction of the Engineer.

**8.2 Guard Rail Systems.** Steel guard rail systems will be paid for at the appropriate contract unit bid price per lineal metre for:

- Erection of Steel Guard Rail System
- Erection of Steel Guard Rail System at Bridge Approaches
- Erection of Steel Guard Rail System at Bridge Columns
- Erection of Steel Guard Rail System at Sign Trusses
- Removal of Steel Guard Rail System
- Adjustment of Steel Guard Rail System

which prices shall be full compensation for the transportation, handling and supply of treated posts and blocks (where required), rails, channels, wings, bolts, washers, all necessary appurtenances, digging and/or auguring of post holes, setting of posts, installing reflectors, backfilling and compacting, disposal of surplus material, removal of guard rail system, adjustment of guardrail system, cleanup of the site and all equipment, plant, labour, quality control and any other incidentals necessary to complete the work to the satisfaction of the Engineer.

**9.0 WARRANTY**



## Division 5 Structures

## Section 7 Cast In Place Concrete

## SECTION 7 - CAST IN PLACE CONCRETE

## 1.0 DESCRIPTION

This section details the requirements for materials and methods in the proportioning, mixing, transport, placement, finishing and inspection of cast in place Portland Cement Concrete (PCC).

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ANSI/ACI 117, Tolerances for Concrete Construction and Materials
- ASTM C 260, Air-Entraining Admixtures for Concrete
- ASTM C 309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM C 494, Chemical Admixtures for Concrete
- ASTM C 1064, Temperature of Freshly Mixed Portland Cement Concrete
- ASTM D 1751, Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
- CGSB 37.2-M, Emulsified Asphalt Mineral Colloid Type Unfilled for Damp-Proofing, Water-Proofing and for Roof Coatings
- CGSB 37.3-M, Application of Emulsified Asphalts for Damp-Proofing or Water-Proofing
- CSA-A5, Portland Cement
- CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- CSA-A23.2, Methods of Test for Concrete
- CSA-A23.5, Supplementary Cementing Materials
- CSA-A362, Blended Hydraulic Cement
- CSA-S269.3, Concrete Formwork
- Drawing HS504.DWG
- Drawing HS505.DWG
- Drawing HS506.DWG
- Drawing HS529.DWG

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Formwork and Falsework.** One copy of drawings and design calculations for Formwork and related Work bearing a Registered Professional Engineer's seal shall be submitted by the Contractor to the Engineer for review at least four (4) weeks before construction. The submission is intended for information purposes only and shall in no way relieve the Contractor of full responsibility to carry out work related in accordance with CSA-S269.3 for Concrete Formwork and CSA-S269.1 for Falsework.

**3.2 Notification of Ready Mix Supplier.** At least two weeks in advance, the Contractor shall advise the Engineer of the qualified Ready Mixed Concrete

Supplier which they propose to use. The Engineer will verify the acceptability of the Supplier and the mixture designs. Acceptance of the Supplier and the mixture designs by the Engineer does not relieve or reduce the responsibility of the Contractor or Supplier from the requirements of the specification.

**3.3 Advance Qualification of Ready Mixed Concrete Suppliers.** The Contractor shall recognize that the Department may qualify in advance, as detailed below, Ready Mixed Concrete Suppliers, however, the Department bears no responsibility for said advance qualification. Liability for the product supplied shall be the sole responsibility of the Contractor.

Ready Mixed Concrete Suppliers may become qualified prior to supplying concrete to Department projects. Qualification may be obtained by submitting current relevant acceptance test data and concrete mixture designs, typically specified for Cast in Place Concrete, to the Department for review prior to the first day of December. Current relevant acceptance test data is defined as data which has been obtained within ninety days prior to the first day of December. The Department will maintain a list of qualified Ready Mixed Concrete Suppliers including their concrete mixture designs. Ready Mix Concrete Suppliers who become qualified in the month of December, shall remain qualified to the thirty first day of December of the following year.

**3.3.1 Required Test Information.** The Ready Mixed Concrete Supplier shall provide relevant test data for all materials indicating conformance to the requirements of CSA-A23.1 and this specification. The sources and test results of all materials shall be clearly identified. The aggregate tests shall be conducted by a testing laboratory, approved by the Department, under the direction of a Professional Engineer registered to practice in Nova Scotia. Test data required shall include, but not be limited to:

- portland cement
- blended hydraulic cement (if used)
- supplementary cementing materials
- admixtures
- water
- aggregates

Aggregate testing shall consist of:

- Sieve Analysis<sup>(1)</sup> of Fine and Coarse aggregate
- Amount of Material Finer<sup>(1)</sup> Than 80 µm in Aggregate
- Bulk Relative Density and Absorption of Fine and Coarse Aggregate (SSD basis)
- Fineness Modulus<sup>(1)</sup> of Fine Aggregate
- Clay Lumps and Light Weight Pieces
- Test for Organic Impurities in Fine Aggregate
- Flat and Elongated Particles in Coarse Aggregates

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- Petrographic Analysis of Coarse Aggregate (PN - NS Test Method)
- Resistance to Degradation of Coarse Aggregate by Abrasion and Impact in the Los Angeles machine
- Micro-Deval test on Coarse and Fine Aggregates
- Soundness of Fine Aggregate by Use of Magnesium Sulphate
- Unconfined Freeze Thaw on Coarse Aggregate
- Test for Detection of Alkali-Aggregate Reactivity (AAR) on Coarse Aggregate (every 2 years).

<sup>(1)</sup>Prior to the first concrete placement, a washed sieve analysis shall be conducted on each proposed stockpiled aggregate at the ready mix plant, representative of the materials to be used in the work and the results submitted to the Engineer by the Contractor.

**3.3.2 Certification and Membership.** The Ready Mixed Concrete Supplier shall provide current plant certification and membership certificates issued by the Atlantic Provinces Ready Mixed Concrete Association (APRMCA).

**3.4 Ready Mix Concrete Suppliers (Not Qualified in Advance).** In the event that the Contractor selects a Ready Mixed Concrete Supplier not qualified in advance by the Department, the Contractor shall, within 4 weeks prior to starting concrete work, submit to the Engineer all of the required information detailed in Subsection 3.3 of this section. The Engineer will verify the acceptability of the Supplier and the mixture designs. Ready Mix Concrete Suppliers who become qualified after January first, shall remain qualified to the thirty first day of December in the same calendar year.

**4.0 MATERIALS**

**4.1 General.** All materials used in the production of concrete shall conform to the referenced standards.

**4.2 Formwork.** Formwork shall be constructed from lumber devoid of warp and defects in order to achieve a face alignment free from distortion. This shall apply to all panel forms including prefabricated boards, plywood and steel panels. Prior to assembly and placement of reinforcing steel all forms and panels shall be treated with a non-staining, non-reactive mineral oil or liquid, as approved by the Engineer. Patching shall be kept to a minimum.

Formwork shall be supported by shores to sustain all horizontal and vertical loads during placing of the PCC.

Column forms shall be seamless heavy gauge galvanized steel and/or fibre column molds.

**4.3 Concrete Mixture Designs**

**4.3.1 Proportioning.** Concrete mixtures shall be proportioned in accordance with CSA-A23.1, Alternative #1, and the Contractor shall accept responsibility for concrete strength. The physical properties for various structural elements are identified in Table 5.7.1 of this specification. Fly ash and/or silica fume may be used, however, the Department reserves the right to limit their proportion to 20% and 10% respectively in the mix.

**4.3.2 Mix Proportions.** The Ready Mixed Concrete Supplier shall select mix proportions that shall produce concrete of specified quality, yield and strength complying with Alternative #1 CSA-A23.1, and Table 5.7.1 of this specification. Typical mixture designs include, but are not limited to:

- 20 mm 25 MPa
- 20 mm 30 MPa
- 20 mm 32 MPa
- 20 mm 35 MPa

A report outlining the proposed mixture designs shall be signed by a Professional Engineer registered to practice in Nova Scotia. The Professional Engineer shall attest to the validity of the material test data stated in Subsection 3.3. Mix designs incorporating alkali reactive aggregate shall be adjusted to limit excessive expansions.

**4.3.3 Changes to Mixture Designs or Material Properties.** If material characteristics change after the Ready Mixed Concrete Supplier becomes qualified, the Contractor shall provide physical properties and certified test results as indicated in Subsection 3.3 of this specification. In the event mixture designs are modified without changing material characteristics, the revised mixture designs shall be submitted to the Engineer.

**4.3.4 Concrete Mix Specifications.** The mix design specifications can be found in Table 5.7.1

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## Section 7 Cast In Place Concrete

Table 5.7.1 - Concrete Mixture Design Specifications

| Element                                            | Footing                        | Leveling Slab     | Tremie   | Roadway Curbs & Sidewalks, Jersey Barrier, Driveway Entrances, Abutment, Wingwall, Slope Protection, Culvert, Road Drain, Sign Base | Bridge Deck Sidewalk, Curb, Parapets, End Posts, Backwall, Beam Seat, Column, Pier Cap |
|----------------------------------------------------|--------------------------------|-------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Maximum Nominal Aggregate, mm                      | 40                             | 20 <sup>(1)</sup> | 20       | 20                                                                                                                                  | 20                                                                                     |
| Minimum 28 Day Compressive Strength, MPa           | 30                             |                   | 30       | 32                                                                                                                                  | 35                                                                                     |
| Maximum Water/cementing Material Ratio             | 0.50                           |                   | 0.45     | 0.45                                                                                                                                | 0.40                                                                                   |
| Minimum Cementitious Content kg/m <sup>3</sup> (2) | 300                            |                   | 390      | 350                                                                                                                                 | 415                                                                                    |
| Air Content %                                      | 6 ± 1                          |                   | 6 ± 1    | 6 ± 1                                                                                                                               | 6 ± 1                                                                                  |
| Slump, mm                                          | 80 ± 20                        |                   | 170 ± 30 | 80 ± 20 <sup>(4)</sup>                                                                                                              | 80 ± 20                                                                                |
| Required Admixtures <sup>(3)</sup>                 | Water Reducer, Air Entrainment |                   |          |                                                                                                                                     |                                                                                        |

(1) Either aggregate size may be utilized unless otherwise specified.

(2) Portland Cement shall be Type 10 Normal unless otherwise specified.

(3) Other admixtures such as Retarders, Accelerators or Superplasticizers may be used if approved by the Engineer.

(4) Lower slump may be required when a slip form machine is used to place concrete.

**4.4 Aggregate Specification.** The maximum Petrographic Number of coarse aggregate shall not exceed 140. The maximum absorption of coarse aggregate shall not exceed 2%. The maximum loss of coarse aggregate, based on the Unconfined Freeze Thaw test, shall not exceed 6 percent. The maximum loss as determined by the Micro Deval test shall not exceed 13 percent for concrete pavements and 17 percent for structures. Coarse aggregate particle shape shall consist of the comparison between the greatest to least dimension of an aggregate particle. Coarse aggregate shall contain not more than 10 percent (Flat/Elongated) of aggregate particles exceeding a ratio of four to one(4:1) based on greatest to least dimensions.

**4.5 Curing Compounds.** Membrane curing compound shall be white pigmented Type 2, meeting the requirements of ASTM C309.

**4.6 Damp-Proofing.** All damp-proofing material shall conform to CAN/CGSB-37.2-M and shall be applied in accordance with CGSB-37.3.

## 5.0 CONSTRUCTION METHODS

**5.1 Formwork Design.** Formwork design and the proposed method of construction shall meet all necessary requirements in terms of strength and properties of material, rigidity and erection tolerances as presented in Subsection 5.1 of this specification.

Formwork shall be built with sufficient strength and rigidity to carry the mass or fluid pressure of the PCC as well as all construction loads including wind, equipment and runways which might be placed upon them. The fluid pressure on forms shall be correlated to the capacity and type of placing equipment, the rate of placing, slump and temperature of the PCC.

Formwork shall be supported by stiff members in two directions at right angles which are sufficiently rigid to hold the unit as a whole in line and in proper position and shape. Formwork shall be accurately located, rigidly tied or braced to resist vertical or horizontal movements and adequately supported. However, they shall be so arranged to allow for easy stripping to prevent damage of the PCC during removal. The use of twisted wires and wood spreaders are prohibited unless approved by the Engineer.

**5.1.1 Formwork/Falsetwork Construction.** The



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Contractor shall construct the falsework and formwork in accordance with the approved drawings. Variations from the drawings shall not be permitted unless such variations are approved by the Designer, and the Engineer is provided with revised drawings prior to construction. Both the falsework and formwork shall be designed and constructed to provide the necessary rigidity and to support the loads without settlement or excessive deflection.

All falsework and formwork used to support fresh concrete during construction of the following components shall be designed by a Registered Professional Engineer in accordance with CSA S269.3:

- bridge decks and pier caps
- columns over 3 m in height
- retaining walls over 3 m in height
- roofs of structures under which persons are required to work
- as required on the contract drawings

**5.1.2 Construction Joints.** The locations and details of vertical construction joints not indicated on the drawings shall be submitted by the Contractor to the Engineer for his approval. PCC in piers and abutments shall be placed without horizontal construction joints unless previously approved by the Engineer.

**5.1.3 Removal/Re-Use of Formwork and Falsework.** Formwork and falsework shall not be removed without the approval of the Engineer.

All formwork and falsework shall be completely removed from the structure. Formwork shall be removed progressively and with care so that corners of PCC members are not damaged or marred.

The time of removal of the falsework shall be determined by the strength and curing requirements of the concrete and the ability of the structure to carry its own dead load and any live or construction load that may be placed on it. Where field operations are controlled by beam or cylinder tests, the formwork and falsework may be removed when the PCC has reached the required strength as determined by the Engineer.

Formwork material intended for re-use shall be clean and in satisfactory condition. Formwork shall not be re-used without the Engineer's approval.

**5.1.4 Formwork Tolerances.** The following tolerances in Table 5.7.2 are permitted for lines, grades or dimensions shown on the contract drawings:

**5.2 Concrete Production.** Concrete shall be produced at a stationary or portable plant. Concrete shall not be supplied to any Department project unless

the Ready Mixed Concrete Supplier is qualified by the Department and so designated.

**5.2.1 Mixing and Transporting.** The concrete materials shall be mixed and transported in a manner which will not segregate or damage the mix in any fashion. Concrete shall be mixed utilizing stationary or truck mixers. The mixer shall carry the Manufacturer's rating plate in a prominent position, indicating:

- the gross volume of the mixer
- the rated maximum mixing capacity
- the minimum and maximum speeds for mixing and agitating of the mixer

Table 5.7.2 - Formwork Tolerance

| Variation From Contract Drawings                                                            | Tolerance                                                         |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| (I) For plumb or specified batter at columns, piers and walls                               | 12 mm in 3 m for Exposed area<br>25 mm in 3 m for Backfilled area |
| (II) For level or specified grade in slabs, beams, horizontal grooves, railing offset, etc. | 12 mm in 3 m for Exposed area<br>25 mm in 3 m for Backfilled area |
| (III) X-Sectional dimensions for Piers, Columns, Beams, slabs, walls, etc.                  | No more than 12 mm<br>No less than 6 mm                           |
| (IV) Bridge Deck Thickness                                                                  | No more than 6 mm<br>No less than 3 mm                            |
| (V) Footing Length & Width                                                                  | No more than 50 mm<br>No less than 12 mm                          |
| (VI) Footing thickness                                                                      | minus 5% of the specified thickness                               |

All mixers shall be capable of combining the concrete ingredients into a thoroughly mixed and uniform mass. In no case shall the mixer loading exceed its rated maximum mixing capacity.

Mixers shall be emptied before charging. The mixer shall be rotated at the Manufacturer's recommended mixing speed during charging and mixing.

Where ready mix trucks are used to transport the concrete, the Department reserves the right to subject any truck suspected of poor mixing to a uniformity test as outlined in CSA-A23. If said truck fails the uniformity test, then the concrete and the truck shall be rejected.

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unless otherwise directed by the Engineer. The truck shall not be permitted on a Department site until appropriate repairs have been completed and certified.

**5.3 Form Preparation/Concrete Placement.** The Contractor shall provide the Engineer with at least 24 hours notice of intent to place concrete in order to permit the Engineer to schedule inspection services. All PCC placing methods shall be subject to the approval of the Engineer.

In preparation for the placing of concrete, all sawdust, chips, construction debris and other deleterious materials shall be removed from the interior of forms. The PCC shall be delivered to the point of final deposit in a manner satisfactory to the Engineer using means and equipment which will prevent segregation or loss of materials. The size of section to be placed in one continuous operation shall be as detailed on the drawings or as directed by the Engineer. PCC for deck slabs shall not be placed between November 15 and April 15, without the written approval of the Engineer.

Unless otherwise authorized by the Engineer, forms shall be kept dry during the placing of the PCC until the PCC has reached initial set. The Contractor shall be held responsible for the placing method used. PCC shall be deposited in the forms in maximum lifts of 500 mm and in layers that are approximately horizontal and as close as practicable to its final position. PCC shall not be moved horizontally with vibrators or by other methods which could cause segregation.

The conveying equipment shall be kept free from deleterious materials and cleaned at frequent intervals. Conveying equipment, if supported by formwork, shall not impart harmful vibration to PCC nor cause misalignment of forms.

Under adverse weather conditions the Contractor shall be prepared to provide suitable protection in order to prevent damage to PCC.

Unless otherwise authorized by the Engineer, wood spreaders shall not be used in any PCC where either face will be exposed or in any wall where water tightness is required.

If the PCC details are such that a feather edge or thin section might be created by the sequence of casting, a bulkhead should be introduced to maintain an edge thickness of at least 100 mm.

**5.3.1 Placing Concrete Under Water (Tremie Method).** Notwithstanding the provisions elsewhere stated in this specification, the following provisions shall apply to PCC deposited under water. PCC shall be

deposited under water only when specifically authorized by the Engineer. The methods, equipment, materials, forms and cofferdams shall be approved by the Engineer before work is started, but such approval shall not in any way relieve the Contractor of liability in connection with the work.

Tremie Concrete shall comply with the provisions of CSA-A23.1. The placing of PCC under water shall be carried on continuously until that portion of the structure is completed.

At the start of the concreting operation, the tremie pipe shall be sealed at the bottom with a plug or foot valve to prevent ingress of water.

All laitance, slime or other matter deposited or formed on the surface of any PCC under water shall be removed before any additional PCC is placed on same.

**5.3.2 Placing and Finishing Bridge Deck Concrete.** The finished surface of the deck concrete shall conform to grades and elevations shown on the contract drawings. Prior to placing deck concrete, the Contractor shall submit to the Engineer detailed information on the method and equipment proposed for handling, placing and finishing of the concrete. The Contractor shall also demonstrate to the satisfaction of the Engineer that all necessary adjustments have been made to provide the required camber, crown, slab thickness and concrete cover over reinforcement, prior to placement.

The surface shall be finished with a mechanical screed machine, which shall be supported by guide rails and span the full width of the deck. Guide rails shall be located outside the finished surface of the deck. Supports for the guide rails shall be capable of fine adjustment and not be fixed to, or located upon, the reinforcing steel. The quantity of supports shall be such that the screed rails do not deflect more than 1 mm during the screeding operation.

Immediately prior to placement of deck concrete, the formwork shall be cleaned and thoroughly moistened. The Contractor shall also moisten the reinforcing steel with water at the request of the Engineer. Deck concrete shall be placed continuously between transverse joints until completion of the section. The placing sequence for continuous structures shall conform with the contract drawings.

The concrete surface shall be floated with a wooden or magnesium float.

The concrete shall be textured by means of a burlap drag, broom or approved alternative.

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There shall be no application of water or cement to the concrete surface for finishing purposes.

Deck concrete shall be water cured as indicated in Subsection 5.5.4 of this specification. During freezing temperatures, water curing shall be terminated 12 hours prior to the end of the protection period.

**5.3.3 Roadway Concrete Curb/Gutter, Sidewalk, Jersey Barrier, Culvert Slabs and Haunches.** Concrete curb/gutter shall be constructed in accordance with this specification and with drawings HS504 and HS505 or as noted in the Special Provision of the contract. Jersey Barrier shall be constructed in accordance with this specification and with drawing HS529 or as noted in the Special Provisions of the contract. Culvert slabs and haunches shall be constructed in accordance with this specification and with drawing HS506 or as noted in the Special Provisions of the contract. Roadway Curb/Gutter, Sidewalk and Jersey Barrier shall be constructed with wood or metal forms or by a slip form paver.

At driveways, concrete curb Type A shall be depressed 100 mm at the road edge and 80 mm at the back. Types B, C and D shall be depressed 120 mm at the road edge and 100 mm at the back. Unless otherwise specified, driveway widths as measured along the depression shall be 3.7 m for a single driveway and 5.0 m for a double driveway.

Catch basin metal frames and grates shall be adjusted to grade prior to placement of adjacent curb and gutter.

Control joints shall be formed by saw cutting or by use of a jointing tool. Control joints shall be constructed at right angles to the edge of the Curb/Gutter, Sidewalk and Jersey Barrier. Saw cuts shall be made between one quarter to one third of the depth of the section and extend along the entire exposed face. Concrete shall be saw cut as soon as possible after finishing without causing excessive raveling and before shrinkage cracks occur. Saw cutting shall be completed within 24 hours of the concrete achieving final set. Sidewalks shall be 1.5 m wide and 100 mm thick except at driveway entrances where the thickness shall be 150 mm. The maximum spacing of control joints for curb/gutter and Jersey Barrier shall be 5.0 m. The maximum spacing of control joints for sidewalk shall be 1.5 m. Control joints shall also be placed at a distance of 1.5 m from the centre of catch basins.

If an isolation jointing material is used, it shall be a pre-molded non-extruding bituminous impregnated fibre-board, 12 mm thick, conforming to ASTM D 1751. The jointing material shall extend the full width and depth of the section and shall be flush with the surface.

Curb/Gutter, Sidewalk and Jersey Barrier shall be cured

as indicated in Subsection 5.5 of this specification.

The Contractor shall backfill the area behind the curb to a distance not exceeding 0.6 m from the back of the curb. The material used shall be of a common or borrow type free from large rock or organic material. Granular materials shall not be used.

**5.4 Consolidation.** All methods of consolidation shall be subject to the approval of the Engineer. PCC shall be consolidated thoroughly and uniformly by means of hand tamping, vibrators or finishing machines to obtain a dense, homogeneous structure, free from cold joints, voids and honeycomb.

A sufficient number of vibrators shall be employed to adequately handle the anticipated rate of placement. The size and frequency of vibrators shall be as specified in CSA-A23.1. A stand-by vibrator shall be available on the site at all times.

Internal vibrators shall be used wherever practicable. External type vibrators may be used where surfaces cannot be properly consolidated with the internal type alone.

Insertion of internal vibrators shall be made systematically at intervals such that the zones of influence of the vibrator overlap.

Extreme care shall be taken to ensure that the internal type vibrators do not displace the reinforcing steel or the forms. Vibrators shall have rubber or non-metallic vibrating heads if epoxy coated reinforcing steel is used.

**5.5 Curing Concrete.** PCC shall be protected from freezing, premature drying, high temperature and moisture loss for a period of time necessary to develop the desired properties of the concrete. Curing shall be applied to PCC as soon as possible without damaging or marring the surface. The curing time shall be as indicated in CSA-A23.1 or this specification. Curing shall be achieved by one or more of the following:

**5.5.1 Burlap.** Two layers of pre-soaked burlap shall be carefully laid on the surface as soon as the PCC has set sufficiently to support the mass of the burlap without marking the surface. Strips shall be overlapped 150 mm, secured to the surface and kept wet throughout the curing period.

**5.5.2 Moisture Vapour Barrier.** The Contractor shall provide an effective vapour barrier and prevent any flow of air between it and the PCC surface. Where polyethylene sheet is used, it shall be white opaque pigmented with a minimum thickness of 100 µm. The vapour barrier shall be secured to the surface and overlapped 150 mm.

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**5.5.3 White Pigment Liquid Membrane.** Curing compounds shall not be used on a surface where a bond is required for additional PCC. A curing compound may be approved by the Engineer under certain circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the PCC. Curing compounds shall be applied at the Manufacturer's recommended application rate. Curing compounds are not permitted on construction joints, surfaces requiring weatherproofing sealants or deck sections.

**5.5.4 Water.** All PCC bridge decks shall be cured with water unless otherwise directed by the Engineer. PCC exposed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placing when Type 10 or Type 50 cements are used. If Type 30 cement is used, the surfaces shall be kept wet for a minimum of three consecutive days after placement. The water for curing shall be clean and free from any material which could cause staining or discoloration of the PCC.

All freshly placed and consolidated PCC shall be suitably protected from the elements and from defacement due to building operations, traffic and vandals. The effects of direct sunshine, drying winds, cold, excessive heat and running water are particularly harmful. The PCC shall be protected by the use of adequate tarpaulins or other suitable material to completely cover, or enclose, all freshly finished surfaces.

**5.6 Hot Weather Concreting.** When the air temperature is at or above 27°C, or is likely to rise above 27°C within 24 hours, special measures, as detailed in CSA-A23.1, shall be taken by the Contractor to protect the concrete from the effects of hot and/or drying weather conditions. The temperature of the formwork, reinforcing steel or the material on which the concrete is to be placed, shall not exceed 27°C.

Concrete temperatures shall not exceed those specified in CSA-A23.1, Table 14.

**5.7 Cold Weather Concreting.** When the mean air temperature is at or below 5°C or when the temperature is likely to fall below 5°C within 24 hours, the Contractor shall place, cure and protect PCC in accordance with CSA-23.1 and this specification.

PCC shall not be placed on or against any surface which is at a temperature less than 5°C. Snow and ice shall be removed before PCC is deposited on any surface. Calcium chloride or other de-icing chemicals shall not be used as a deicing agent in the forms.

If the Department specifies heating of the mix water and/or aggregates, the charging cycle shall be altered to prevent flash setting of the PCC. Aggregates and water shall not be heated above 80°C. Water and/or aggregates heated to a temperature in excess of 40°C, shall be batched in the mixer first to reduce the temperature of the combination below 40°C, prior to the addition of the cementing materials. All frozen lumps of aggregate shall be excluded from the mix.

**5.8 Protection Classes.** Protection and curing depends upon the outside temperature, the wind velocity, and the size of the PCC section. Under normal circumstances the following methods of protection may be required to maintain the protection necessary for the conditions described.

Heating of the mixing water and/or aggregates shall be required for all classes of protection.

**5.8.1 Special Protection.** When the outside temperature during placing or during the protection period may fall below 5°C, adequate covering of all surfaces with tarpaulins or polyethylene sheets shall be provided.

**5.8.2 Special Protection with Insulation.** When the outside temperature during placing or during the protection period may fall below 0°C, all surfaces shall be covered with an approved insulating material, over which tarpaulins or polyethylene sheets are placed.

**5.8.3 Complete Housing with Heat.** When the outside temperature during placing or during the protection period may fall below -5°C, a complete housing of the PCC, together with supplementary heat, shall be provided. The Contractor shall ensure that heat is supplied uniformly around the PCC. For mass concrete, defined as minimum section dimension in excess of 2 m, the temperature gradient shall not exceed 20°C/m from the interior of the element to the exterior face. In thin sections, less than 2 m, the temperature differential from the interior to the exterior shall not exceed 20°C. Steam or hot air blowers may be used, but a means of maintaining relative humidity of not less than 95% shall be provided. When dry heat is used, hot air shall not be permitted to flow directly onto the PCC surface. Exhaust fumes shall be vented.

The protection and curing shall continue to maintain the temperature of the PCC at not less than 10°C for five days after placing. The PCC shall be kept above 0°C for a total period of fourteen days. If Type 30 cement is used, the protection period may be reduced to 70% of the stated times.

At the end of the curing and protection period,



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protection and heating shall be withdrawn in such a manner as not to induce thermal shock stresses in the PCC. The temperature of the concrete shall be gradually reduced to avoid cracking due to sudden temperature changes near the end of the curing period. The protection shall not be completely removed until the concrete has cooled to the temperature differential stated in Table 15 of CSA-A23.1.

**5.9 Concrete Surface Finish**

**5.9.1 Formed Surface.** All formed surfaces shall receive the basic treatment as indicated below. In addition to the basic treatment, all exposed surfaces shall receive a "Smooth Form" finish as indicated below.

**5.9.1.1 Basic Treatment.** Upon removal of the forms, all cavities, honeycomb, and other deficiencies shall be patched with a sand cement mortar of the same composition as that used in the PCC. Mortar shall be composed of cement, fine aggregate and water, proportioned and mixed as specified. When the proportioning of cement and fine aggregate is not specified, the mortar shall consist of one (1) part by volume of cement and two (2) parts of fine aggregate. The quantity of water used in mixing the mortar shall be sufficient to make it capable of being freely spread with the trowel. Mortar shall be mixed in quantities which can be utilized within 60 minutes. Mortar shall not be re-tempered or remixed with water after initial set.

All bolts, ties, nails, or other metal not specifically required for construction purposes, shall be removed or cut back to a depth of 25 mm from the surface of the PCC unless otherwise directed by the Engineer. The cavity shall be kept saturated for 60 minutes prior to the application of a latex bonding agent or neat cement paste. The mortar shall be pressed or packed into the depressions so as to completely fill the cavity and then finished to match the adjacent surface. Fins, unsightly ridges, or other imperfections shall be chipped or rubbed off flush with the surface. Mortar patches in excess of 25 mm shall be applied in layers not exceeding 25 mm with a 30 minute interval between the placing of layers. The surface of the patch shall be textured equivalent to the adjacent concrete.

Honeycomb areas or cavities over 25 mm in diameter shall not be repaired until inspected by the Engineer. Where honeycombing has occurred in non-structural elements, the affected area shall be removed and filled with mortar as previously described. Where honeycombing has occurred in structural elements, the corrective method of treatment shall be carried out as directed by the Engineer.

All concrete and mortar shall be cured and protected in accordance with CSA-A23.1 and Subsection 5.5 of this specification.

**5.9.1.2 Smooth Form Finish.** A Smooth Form Finish shall be a uniform, high quality concrete which has been homogeneously placed and thoroughly compacted. A Smooth Form Finish shall be uniform in colour, pattern and texture. Curbs, sidewalks, parapet walls, abutments, piers and any other surfaces the Engineer may designate, shall have a Smooth Form Finish.

If the concrete, after form stripping and the basic treatment, does not exhibit such finish, the Contractor shall perform any or all of the following operations, as directed by the Engineer, in order to obtain a Smooth Form Finish:

- cut out all corrodible metal within 25 mm of the surface and repair the cavities as indicated in Subsection 5.9.1.1, basic treatment.
- remove fins and other projections to leave a smooth, plane surface.
- remove stains, rust marks or other blemishes which detract from the specified uniformity of appearance.

**5.9.2 Open Surfaces.** The finished surface of concrete placed for such items as bridge decks, approach slabs, sidewalks and curbs shall conform to the lines, grades and elevations shown on the contract drawings and as stated herein.

**5.9.2.1 Sidewalks.** Sidewalk surfaces shall be laid out in blocks by use of a jointing tool, saw cutting or as indicated on the plans. Concrete edges and expansion joints shall be formed in the concrete at the designated locations. Joints shall be rounded using a 6 mm radius edging tool. Sidewalk surfaces shall be struck-off with a strike board and floated. The finished surface shall not vary more than 3 mm under a 3 m straight edge and shall be lightly broomed transversely to produce a textured, non-slip surface.

**5.9.2.2 Decks.** The finish deck surface shall be tight, smooth, free from ridges, depressions, undulations or blemishes. The surface shall receive a texture finish as indicated in Subsection 5.3.2 of this specification. Except across the crown, the deck surface shall be such that when tested with a 3 m long straight edge placed in any direction, there shall not be a gap greater than 8 mm between the bottom of the straight edge and the surface of the concrete.

Areas which do not meet the required surface profile shall be clearly marked and removed by the Contractor at the Contractor's expense. The Contractor shall, as directed by the Engineer:



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- grind down any areas higher than 3 mm but less than 10 mm
- remove and replace deviations exceeding 10 mm. The quality of the repair shall be equal to or greater than the adjacent concrete in the undisturbed slab.

**5.10 Damp-Proofing.** The back face of abutments, wingwalls and retaining walls, from the top of footing to underside of curbs, as well as the top and sides of "culvert type structures", where PCC will be in contact with the earth fill, shall be damp-proofed.

Damp-proofing shall consist of one coat of emulsified asphalt diluted with clean water to a maximum of 50% by volume applied uniformly by brush or spray at the rate of 0.4 to 0.5 L/m<sup>2</sup> of surface area, followed, after the prime coat has cured, by one full strength coat of emulsified asphalt applied at a minimum rate of 0.5 L/m<sup>2</sup> of surface area.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 General.** Concrete shall be tested by the Department or its representative, at the point of discharge as delivered to the work site. Testing shall include but not be limited to:

- air content - CSA-A23.2-4C
- slump - CSA-A23.2-5C
- temperature - ASTM C 1064
- compressive strength - CSA-A23.2-9C

Testing by Department personnel, or representative, shall not relieve the Contractor of the overall responsibility for the strength and acceptability of the concrete supplied.

**6.2 Field Adjustments.** In the event that the slump and/or air content are outside the specified limit, the Contractor shall be allowed one adjustment to the concrete, conforming to the procedures outlined in CSA-A23.2. If when retested, the concrete fails to meet Department Specifications, it shall be rejected unless otherwise directed by the Engineer. A minimum of two tests shall be performed on the failing property prior to concrete rejection. The Engineer shall be notified prior to any mix adjustments, however, this shall not relieve the Contractor of the responsibility to provide the specified compressive strength.

No water shall be added after the initial introduction of the mixing water for the mix, except at the start of discharge and when

- the measured slump is less than specified, and
- no more than 60 minutes <sup>(1)</sup> have elapsed after water and cement have been combined, and
- the concrete is in a stationary or truck mixer

<sup>(1)</sup> Subject to discretion of the Engineer, this time limit may be extended.

**6.3 Strength Tests.** For the purpose of acceptance on the basis of compressive strength, a set of cylinders shall be cast, cured and tested in accordance with the relevant specification indicated in Subsection 6.1 of this specification. The specified 28 day compressive strength is the acceptance criteria for concrete. A set of cylinders shall consist of three specimens, one specimen tested at 7 days and the remaining two tested at 28 days. The compressive strength shall be the average of the two 28 day test results.

**6.4 Strength Criteria.** The Department reserves the right to reject any concrete which does not meet all the requirements for the class of concrete specified.

Concrete shall be tested in accordance with CSA-A23.1. The strength of each class of concrete shall be considered satisfactory if:

- the average of three consecutive strength tests equals or exceeds the specified strength, and
- no individual test is 3.5 MPa below the specified strength

**6.4.1 Under Strength Concrete.** Where the average of three consecutive strength tests is below the specified compressive strength, or any individual test is 3.5 MPa below the specified compressive strength, the Department may require replacement or reinforcing, at the Contractor's expense, of that portion of the structure. The Contractor may request coring to verify the insitu compressive strength of the section in question, however, such testing shall be conducted by a qualified independent testing laboratory at the Contractor's expense. A minimum of three cores shall be taken at locations determined by the Engineer. The compressive strength of all cores obtained shall be at least 85% of the specified compressive strength and no individual test result less than 75% of the specified strength. All testing shall be conducted in accordance with CSA-A23.2-14C.

If the average compressive strength of the cores meets or exceeds the specified compressive strength the cost of coring by the testing laboratory shall be borne by the Department. The Contractor shall not be reimbursed for inconvenience and other associated costs of coring.

**7.0 METHOD OF MEASUREMENT**

**7.1 General.** Measurement shall be made at the contract unit price per cubic metre for Cast in Place Concrete and Concrete in Bridge Decks. The quantity of concrete for payment shall be the volume in cubic metres computed from the dimensions shown on the

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drawings or as revised by the authority of the Engineer. No deductions shall be made for the volume of concrete displaced by steel reinforcement, joint material, structural shapes, chamfers, tops of piles, or cylindrical voids of 110 mm diameter or less.

**7.1.1 Mud and Leveling Slabs.** The quantity of concrete used for Mud or Leveling Slabs shall be determined by volume in cubic metres based on the delivery slip and placed in the work.

**7.1.2 Curb/Gutter.** The quantity of Curb/Gutter, including curb backing, shall be measured by the linear metre for the length accepted by the Engineer. No deduction shall be made for the reduced height at driveways and other entrances.

**7.1.3 Sidewalks and Driveways.** The quantity of Sidewalk, Driveway and other entrances shall be measured by the square metre accepted by the Engineer and placed in the work.

**8.0 BASIS OF PAYMENT**

**8.1 General.** Concrete cast above the abutments and/or pier beam seat elevations within the area of the bridge deck shall be considered Concrete in Bridge Decks. It shall include all concrete in deck slabs, diaphragms, curbs, sidewalks, and parapet walls which are located in the bridge superstructure between the front faces of the abutment back walls. All other concrete shall be paid for as Cast in Place Concrete.

Except as noted herein payment will be made at the contract unit price bid per cubic metre for Cast in Place Concrete and Concrete in Bridge Decks. The payment shall be considered full compensation for the cost of furnishing all materials, aggregates, cement, supplementary cementing materials, water, admixtures, and other materials, non-metallic expansion joint

materials, tools, equipment, falsework, forms, bracing, labour, curing, surface finish, damp-proofing and all other items of expense required to complete the concrete work as shown on the plans, and as outlined in the specifications.

Payment for roadway Curb/Gutter and Jersey Barrier will be made at the contract unit price bid per linear metre. Payment for curb backing shall be included in the unit price for Curb/Gutter. Payment for Roadway Sidewalk and Driveway entrances will be made at the contract unit price per square metre.

**8.2 Payment for Cold Weather Concreting.** If it is considered necessary by the Department to place concrete in cold weather, additional payment for Cold Weather Concreting will be paid. Payment shall be as detailed in the Appendix C and shall be considered payment in full for the complete protection, as outlined in this specification.

If, in the opinion of the Engineer, the placing of concrete under cold weather conditions is a result of unjustified delays, negligence, etc. on the part of the Contractor, the precautions described herein shall be followed and the cost thereof shall be borne in full by the Contractor. If the Contractor wishes to place concrete during cold weather, but if in the opinion of the Engineer, this is not required to meet the original completion date, additional payment will not be made for the Cold Weather Concreting but the precautions taken shall follow the methods outlined herein. The Contractor must receive an extension, prior to the original completion date, if the contract exceeds the original completion date, before consideration will be given to the payment of Cold Weather Concreting.

**9.0 WARRANTY**

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## Section 8 Precast Prestressed Concrete Girders

## SECTION 8 - PRECAST, PRESTRESSED CONCRETE GIRDERS

## 1.0 DESCRIPTION

This section details the manufacture, delivery, storage and erection of precast, prestressed concrete girders.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM C 260, Air-Entraining Admixtures for Concrete
- ASTM C 494, Chemical Admixtures for Concrete
- ASTM C 1064, Temperature of Freshly Mixed Portland Cement Concrete
- CAN3-G279.2, Steel Wire in Mill Coils for Prestressed Concrete Railroad Ties
- CSA A-5, Portland Cement
- CSA A23.5, Supplementary Cementing Materials
- CSA-A362, Blended Hydraulic Cement
- CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- CSA-A23.2, Methods of Test for Concrete
- CSA-A23.4, Precast Concrete - Materials and Construction
- CSA-S6-88, Design of Highway Bridges
- CSA S269.3, Concrete Formwork
- Division 5 Section 7, Cast-in-Place Concrete
- PCI Manual for "Quality Control for Plants and Production of Prestressed Concrete Products

## 3.0 SUBMISSIONS

**3.1 Shop Drawings.** At least four (4) weeks prior to the proposed commencement of girder manufacture, the Contractor shall submit the shop drawings directly to the Manager of Highway & Bridge Design for review and approval. The manufacture of the girders shall not proceed until the final approval of shop drawings. Approval of the shop drawings by the Department will, not under any circumstances, relieve the Contractor of the responsibility for correctness of dimensions, size of components and the details of manufacture. The shop drawings shall include: girder details, reinforcing steel schedule, specification of prestressing strand, detensioning sequence, lifting points, as well as all hold-down details on draped or deflected strand.

**3.2 Erection Procedure.** At least four (4) weeks prior to the commencement of erection of girders, the Contractor shall submit to the Manager of Highway & Bridge Design details of erection procedures including lifting methods.

**3.3 Concrete Mix Design.** The mix design shall be submitted as per Subsection 3.4 of Division 5 Section

7 at least four weeks prior to girder manufacture. This approval will not relieve the Manufacturer of responsibility for correctness or strength requirements.

**3.4 Certification.** The Manufacturer of prestressed concrete girders shall be certified in accordance with CSA A23.4 prior to the time of tender. Proof of this certification shall be provided to the Manager of Highway & Bridge Design by the Contractor prior to award of the contract.

## 4.0 MATERIALS

**4.1 Concrete.** Concrete shall conform to the provision of Division 5 Section 5 of the specifications except as varied herein. The Manufacturer is responsible to provide a mix design meeting the minimum 28 day compressive strength as indicated on the drawings. The nominal maximum size of coarse aggregate shall not be larger than 20 mm and the water/cementing materials ratio shall not exceed 0.40. The air content of plastic concrete shall meet the requirements of Table 9 Category 1 of CSA A23.1. The slump shall not exceed 75 mm. If a superplasticizer is used, the slump may be increased to 230 mm provided there is no evidence of segregation.

**4.2 Reinforcing Steel.** Reinforcing steel shall conform to Division 5 Section 5 of the Standard Specifications. Chairs for supporting reinforcing shall be plastic or plastic tipped.

**4.3 Prestressing Strand.** Prestressing strand shall consist of seven wires having a centre wire and six outside wires, conforming to the latest edition of CSA G279.2. Prestressing strand shall be stabilized having a nominal diameter of 12.7 mm and ultimate tensile strength of 1860 MPa, unless otherwise specified. Prestressing strand shall be furnished either in coils, or on reels and shall be tagged to provide the following information: strand type, manufacturer, length, reel number, modulus of elasticity and ultimate strength. Each reel shall be accompanied by a stress-strain curve.

All prestressing strand must be clean and free from deleterious materials which may prevent bond between the strand and concrete. In cases where a bond break is required, the debonding material provided shall be in accordance with the approved shop drawings. Casting bed soffits shall be covered with a non-absorbent, waxed paper or an approved equivalent to prevent form release agents from contaminating the prestressing strand. Prestressing strand having kinks, nicks, bends or other defects shall not be used.

**4.4 Inserts.** The Manufacturer shall supply and install all inserts in the girders, as shown on the approved

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## Section 8 Precast Prestressed Concrete Girders

shop drawings. This item shall include lifting and handling devices as well as anchors for hold-down devices.

**4.5 Lifting Devices.** Lifting devices for the girders shall be submitted with the shop drawings for approval by the Department.

**5.0 CONSTRUCTION METHODS**

**5.1** The manufacture of the precast prestressed concrete girders shall be in accordance with CSA-A23.4, "Precast Concrete Materials and Construction".

**5.2 Manufacturing Restriction.** Between October 31 and April 1, or when the air temperature is at or below 5°C or if there is a probability of it falling below 5°C within 24 hours, girders shall be manufactured and protected in suitable enclosures or shelters.

**5.3 Notification.** The Contractor shall notify the Department 48 hours before any phase of the girder manufacture is commenced.

**5.4 Dimension Tolerances.** Girder dimensions shall meet the following tolerances:

|                 |                 |
|-----------------|-----------------|
| depth (flange)  | ± 6 mm          |
| depth (overall) | + 12 mm, - 6 mm |
| width (overall) | + 10 mm, - 6 mm |
| width (web)     | + 10 mm, - 6 mm |
| length          | ± 20 mm         |

Exposed Beam Deviations (from square or designated skew):

|                                       |               |
|---------------------------------------|---------------|
| horizontal (including girder ends)    | ± 15 mm       |
| vertical (including girder ends)      | ± 15 mm       |
| inserts, pipe sleeves (ctr to ctr)    | ± 12 mm       |
| stirrup (projection)                  | + 6 mm, -20mm |
| reinforcing steel                     | ± 25 mm       |
| handling devices                      | ± 150 mm      |
| deflection points (anchors)           | ± 150 mm      |
| ctr. of gravity of strand group       | 6 mm max      |
| bearing plates (deviation from plane) | ± 3 mm        |
| bearing plates (ctr. to end of beam)  | ± 16 mm       |

**5.5 Prestressing**

**5.5.1 Pretensioning.** The prestressing strand shall be accurately held in position and stressed by jacks. If multiple strands are tensioned simultaneously, provision shall be made to include the same initial stress in each. Strands shall be tensioned to the initial tension as indicated on the approved shop drawings prior to final stressing. The variation from the specified prestress force shall not be more than 5% on the parallel strand and 7% on the draped strand. The elongation of strand shall be adjusted for the effect of temperature variations if the temperature of the steel at the time it is stressed differs by more than 15°C from the time of placement of the concrete. After three days a minimum of three strands shall be inspected. If any one shows significant movement then the remaining strands will be restressed.

One splice will be permitted per straight strand providing that no splice falls within the girder. The strand to be spliced shall have the same lay or direction of twist. If strand splices are used elongations must be adjusted to account for slippage at the splice.

Rotation of a jacking ram shall be limited to not more than one revolution per 30 m of exposed tendon. Welding of strand shall not be permitted.

**5.5.2 Detensioning.** Detensioning shall not proceed until the concrete in the girders has achieved the required release strength. Release cylinders shall be broken in the presence of the Department's representative. The strength shall be considered acceptable if the average of two cylinder breaks meets or exceeds the specified release strength. In single strand detensioning, the strand shall be released by heat-cutting, using a low oxygen flame or by jacking.

**5.6 Concrete Placing.** Concrete shall not be placed without the approval of the Department or its representative. Concrete placing methods and equipment shall be such that the concrete is conveyed and deposited at the required consistency without segregation or affecting the specified qualities of the concrete. The top surface of the girders shall be free of laitance and intentionally roughened unless specified otherwise.

**5.7 Concrete Curing.** Curing shall be carried out using water or steam. Side forms may be removed when the concrete strength reaches 20 MPa, however water or steam curing must continue until release strength is achieved.

**5.7.1 Water Curing.** Water shall be clean and free from any materials which may cause discolouration or other harmful effects to the concrete. The girders shall be maintained on the casting beds in an approved manner, designed to keep the units continuously wet and at a controlled temperature. Water curing shall be continued until the required release strength is obtained. If tarpaulins are used to enclose girders they must be clean and free from holes. Tarpaulins shall remain over the girder until release strength is obtained.

**5.7.2 Steam Curing.** The girders shall be maintained on the casting beds in an approved manner. The initial application of steam shall not commence until after initial set of the concrete. Steam shall not be discharged directly onto the concrete, forms or test cylinders. The ambient temperature within the enclosure shall be increased at a uniform rate not exceeding 20° C/hr. The maximum curing temperature shall not exceed 80°C. When release strength is reached, the ambient temperature shall be decreased at a maximum rate of 20°C/hr. The time-temperature relationship shall be recorded throughout the curing period.

**5.8 Final Finish.** Girders shall be finished as indicated



**Division 5 Structures****Section 8 Precast Prestressed Concrete Girders**

on shop drawings. Girders shall be repaired and finished in suitable enclosures or shelters where the ambient temperature is maintained above 10°C, and cured at this temperature for at least 24 hours. The sides of the girders shall be water jetted prior to sacking at a pressure which will not damage the concrete but will expose air pockets. The girder surface shall be sack rubbed finished in accordance with the latest edition of CSA-A23.1. Sacking materials can be cured with a curing compound approved by the Department.

**5.9 Girder Ends.** At the ends of girders which are to be cast in concrete the prestressing stand shall be burned or cut off flush with the end of the girder and the strand shall be coated with a rust protector. At the ends of girders which are not to be cast in concrete the stand shall be burned into a depth of 10 to 20 mm. All depressions left from burning shall be filled with epoxy. All slag and rough concrete shall be ground off prior to the application of two coats of asphaltic material over the entire surface of the girder ends.

**5.10 Acceptance.** All girders shall be inspected and accepted by the Department's representative prior to shipment.

**5.11 Repairs.** Repair work shall be done in accordance with CSA A23.4 and Subsections 5.11.1 and 5.11.2 of this specification. Repairs of minor defects are referred to as cosmetic repairs, while extensive defects are considered structural.

**5.11.1 Cosmetic Repairs.** Repairs of defects and damage to precast concrete girders shall be performed with materials in a manner that will restore the specified quality of the product.

When the defect in a girder end is less than  $\pm 15$  mm, no repair is required and the beam will be coated with the standard end coating. When the defect exceeds  $\pm 15$  mm it shall be considered a structural repair.

**5.11.2 Structural Repairs.** No repairs of a structural nature shall be undertaken until the Department has evaluated the damage. A defect or damage will be considered structural when:

- Main reinforcement or strand are exposed.
- Any cracking in bearing areas.
- Any cracking extending from one face of the element through to the opposite face.
- Cracks larger than 0.3 mm extending longer than 100 mm.
- Cracks larger than 0.2 mm in an area of tensile stress.

When an element is considered to have structural damage, repair procedures may include; grinding, epoxy coatings and epoxy injection. If epoxy is used it must be approved by the Department.

**5.12 Identification, Handling and Storage.** Girders shall be identified by stencilling or painting as indicated on approved shop drawings. In addition, each girder end shall be identified by a direction marker. No girder shall be lifted by using pickup points other than those indicated on the drawings or as approved by the Department. Girders shall be supported at a distance from the ends of the girder, not exceeding 1.5 times the depth of the member.

**5.13 Transportation and Delivery.** Girders shall not be shipped until the concrete has reached the specified 28 day compressive strength. Compressive strengths will be determined by obtaining the average of two test cylinders cured with the girder. Girders shall be loaded and delivered in an approved manner. Damage incurred during transportation, handling and erection shall be the responsibility of the Contractor and shall be repaired to the satisfaction of the Department.

**5.14 Erection of Girders.** Girders stored on site shall be supported on properly constructed blocking, until they are placed in the structure. All girders shall be erected by the Contractor in accordance with the approved erection drawing.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 General.** The Manufacturer is responsible to maintain accurate records of all phases of the girder manufacture.

Quality control testing shall be conducted by the Manufacturer and verified by the Department or its representative. A certificate of accuracy for scales or measuring devices shall be provided upon request. For each contract, prior to the first concrete placement, a wash sieve analysis shall be conducted on each proposed stockpiled aggregate and the results submitted to the Department or its representative. Testing shall be representative of the materials to be used in the work. Testing shall also include the determination of slump, air content, temperature, unit weight and the casting of cylinders. The frequency of concrete testing shall be at the discretion of the Department or its representative. For each days bed production, a minimum of four 28 day compressive strength cylinders shall be cast by the Manufacturer, two for the Department and two for the Manufacturer.

A minimum of two cylinders shall be cast to determine release and shipping strength for each girder produced. The release cylinders shall be cured and stored under the same conditions as the concrete in the girders.

Test specimens of the prestressing strand may be obtained from each coil and verified by the Department to determine compliance with the requirements of this specification.



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The Department's representative will inspect the following phases of girder manufacture:

- prestressing operations
- installation of reinforcing steel, inserts, etc.
- aggregate testing
- concrete production, placement and curing
- detensioning operations
- finishing of girders
- dimension tolerances
- handling and storage
- transportation and delivery

The Contractor shall ensure that safe working conditions exist. The Department's representative will have the authority to stop operations if the girders do not conform to shop drawings or specifications.

**7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

**8.1 General.** Payment will be at the contract lump sum bid price for Precast Prestressed Concrete Girders. This price shall be full compensation for all labour, materials, plant and services necessary to manufacture, deliver and erect the girders in the final position, as shown on the shop drawings, and to the satisfaction of the Engineer.

**8.2 Partial Payment.** Where girders are not delivered to the job site but are delivered to a temporary storage site on property owned or leased by the Department with the prior approval of the Engineer, partial payment for the fabrication and delivery of the girders may be made, which payment will be the lesser of the Manufacturers invoice price less 15% or the tender amount less 15%. Payment will only be made at the Contractor's request.

**9.0 WARRANTY**

## Division 5 Structures

## Section 9 Waterproofing Concrete Bridge Decks

## SECTION 9 - WATERPROOFING CONCRETE BRIDGE DECKS

## 1.0 DESCRIPTION

This section details the surface preparation, application of tack coat, application of membrane reinforcement, application of hot rubberized asphalt (waterproofing) and placing protection boards on concrete bridge decks.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- CGSB 37-GP-50M

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The Contractor shall give a minimum of 48 hours notice, in writing, prior to commencement of any waterproofing operations.

When the contract requires that an asphalt riding surface be stripped from the existing concrete structure deck, the Contractor shall give at least one week's notice to the Engineer, in writing, before commencement of the asphalt stripping operation.

Test results for the Water Absorption Test of the protection board shall be submitted to the Engineer one week prior to installation.

## 4.0 MATERIALS

**4.1 Tack Coat for Bridge Deck Surface.** The tack coat for the bridge deck surface shall be a Liquid Asphalt Primer in accordance with these specifications.

**4.2 Hot Applied Rubberized Asphalt Waterproofing Membrane.** The waterproofing membrane shall be a hot applied rubberized asphalt waterproofing membrane certified by the Manufacturer to conform to the requirements of CGSB 37-GP-50M. The waterproofing membrane shall be supplied to the job site in cakes in the Manufacturer's sealed and labeled containers ready for melting and application.

A sample of the waterproofing membrane shall be tested and approved by the Department or its representative before the actual work is started in the field. Samples shall also be taken randomly from the heating and mixing kettle throughout the duration of the contract. The waterproofing shall conform to the requirements in Table 5.9.1

Table 5.9.1 Physical Requirements of Hot Applied Rubberized Asphalt Waterproofing Membrane

| Test                     | Specification (mm) |
|--------------------------|--------------------|
| Cone Penetration at 25°C | 110 (max)          |
| Cone Penetration at 50°C | 160 (max)          |
| Flow at 60°C             | 3 (max)            |

Test results shall be submitted by the Contractor to the Engineer one week prior to installation, however, the Engineer may take samples for testing at any time during the operation.

**4.3 Protection Board.** The protection board shall be formed of asphalt and fillers between two sheet materials. The board shall be uniform over its entire area to the thickness specified. The board shall remain free from perforations when applied.

The protection board shall be so packaged as to permit shipping, handling, and storage without damage to the contents.

The thickness of the protection board shall be 3.6 mm  $\pm$  0.4 mm. The width of the board shall be 1000 mm  $\pm$  150 mm and the length of the board shall be 1500 mm  $\pm$  150 mm. The board shall have straight edges, square corners, and edges free of burrs and breakaways.

Notwithstanding the size tolerance above, all sheets shall be of the same length and width with a tolerance of  $\pm$  5.0 mm and of uniform thickness within a tolerance of  $\pm$  0.25 mm.

The protection board shall have a water absorption of 5.0% maximum and shall show no deterioration or loss of mass during the Water Absorption Test.

## 5.0 CONSTRUCTION METHODS

All waterproofing operations shall be carried out when the air and concrete surface temperature is 5°C or higher.

The applicator shall be approved by both the Engineer and the Manufacturer of the waterproofing system.

The Contractor shall perform all of the operations involved in waterproofing in sequential order, such that there are no delays between individual operations other than those necessary to meet the requirements of these specifications.

**Division 5 Structures****Section 9 Waterproofing Concrete Bridge Decks**

Drainage holes through the deck shall not be plugged or covered by either waterproofing membrane or protection boards or asphalt concrete.

**5.1 Surface Preparation - New Concrete Bridge Decks, Concrete Overlays and Existing Concrete Bridge Decks.** The existing surface of the concrete shall be completely treated by abrasive blast cleaning, or such methods as approved by the Engineer to ensure that sound, latent - free concrete is exposed. If a curing compound had been used on the concrete surface, it shall be completely removed.

The flatness of the surface shall be checked after the surface preparation has been completed. Areas that do not meet a 3 mm in 3 m planeness shall be ground by the Contractor.

All dirt and debris shall be swept off and disposed of before tack coating. Immediately prior to the application of the tack coat, the concrete surface shall be cleaned with a jet of oil-free compressed air to remove all dust and foreign material.

**5.2 Modification of Joint Assemblies of Existing Concrete Bridge Decks.** Any modifications to the expansion joint assemblies shown on the contract drawings shall be carried out prior to waterproofing.

**5.3 Approval.** Waterproofing shall not commence until the Engineer has approved all preparation work.

**5.4 Tack Coating of Prepared Concrete Deck.** A tack coat of Liquid Asphalt Primer shall be applied to the concrete deck at a rate of 0.25 L/m<sup>2</sup> with approved equipment which shall provide a uniform application at the required rate. The tack coat shall be applied when the concrete is dry and clean. Waterproofing equipment shall not be permitted upon the tack coat until it has fully cured.

**5.5 Heating and Mixing of Hot Applied Waterproofing Membrane.** Cakes of the waterproofing membrane shall be melted on the job site in a double boiler oil heat transfer type mechanically agitated heating and mixing kettle. This unit shall keep the contents continuously agitated until the material can be drawn free flowing and lump free from the mixing kettle at a temperature within the range recommended by the Manufacturer. The kettle shall be equipped with functional permanently installed dial type thermometers to measure the temperature of the melted compound and the oil.

**5.6 Application of Hot Applied Waterproofing Membrane and Membrane Reinforcement.** The waterproofing membrane shall not be applied until the tack coat of liquid asphalt primer has cured completely,

and is free of any surface moisture and dirt. The waterproofing shall be applied within the temperature range recommended by the Manufacturer in the following sequence:

- Apply the waterproofing along the edge of the deck for a width of 300 mm and up the face of the curbs or barrier walls to a height of 80 mm.
- Place a sheet of rubber membrane reinforcement (minimum 150 mm wide by 1.2 mm thick) up the face of the curbs or barrier walls to a height of 40 mm while the waterproofing is still tacky.
- Apply waterproofing over the rubber membrane reinforcement.
- Apply the waterproofing to the tack coated deck, so as to form a uniform film having a thickness of  $5 \pm 1$  mm.

**5.7 Application of Protection Board.** Protection boards shall be laid on the waterproofing membrane while the surface is still tacky with the length of the board transverse to the deck centerline. Materials or substances shall not be applied to remove the tackiness prior to installation of the protection board. The protection boards shall be placed with edges overlapping  $12 \pm 6$  mm both longitudinally and transversely. The protection board edge shall be within 6 mm of all curbs, drain verticals, and expansion joint verticals. Protection boards shall be placed such that the longitudinal (direction of traffic flow) joints are staggered a minimum of 150 mm.

**5.8 Paving of Deck.** Asphalt concrete paving of bridge decks shall be done in accordance with Department Specifications. The asphalt concrete shall be placed within 48 hours of the completion of waterproofing or as otherwise directed by the Engineer.

**5.9 Sealing Interface Between Asphalt Concrete and Curb.** Within 24 hours of asphalt concrete paving of the deck, the interface between the asphalt concrete and the face of the curb shall be sealed by pouring waterproofing along the joint such that the material extends 25 to 50 mm from the face of the curb and to a thickness of 2 to 4 mm above the asphalt concrete.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Protection Board.** The protection board shall be tested using the Water Absorption Test. Two specimens of protection board 150 mm x 50 mm shall be cut. The specimens shall be oven dried to constant mass at  $60^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . The mass of the specimens before and after drying shall be recorded. The specimens shall then be submerged horizontally under 25 mm of water three times as follows:

- First Immersion: The water temperature shall be  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and the duration of the immersion shall be 4 hours.

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- Second Immersion: The water temperature shall be  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and the duration of the immersion shall be 20 hours.
- Third Immersion: The water temperature shall be  $60^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and the duration of the immersion shall be 80 hours.

After each immersion the specimens shall be towel dried and the mass recorded.

The percent mass loss or gain from the original oven dry mass shall be recorded.

The Engineer may take samples for testing at any time during the operation.

**7.0 METHOD OF MEASUREMENT**

Waterproofing concrete bridge decks shall be measured for payment by the square metre. The area measured will be the surface of the deck covered with waterproofing material measured along the plane of the

deck surface.

**8.0 BASIS OF PAYMENT**

Waterproofing concrete bridge decks will be paid for at the contract unit bid price per square metre for Waterproofing Concrete Bridge Decks which price shall include the preparation of the surface, the supply and placing of tack coat, the supply and placing of the membrane reinforcement, waterproofing and protection boards, sealing of interface, and traffic control, and shall include all equipment, labour, material and services necessary to waterproof the deck to the satisfaction of the Engineer.

If the waterproofing is damaged, it shall be repaired immediately, prior to final paving, to the satisfaction of the Engineer and at no extra cost to the Department.

**9.0 WARRANTY**





## Division 5 Structures

## Section 10 Structural Plate Pipe

## SECTION 10 - STRUCTURAL PLATE PIPE

## 1.0 DESCRIPTION

This section details the supply and installation of a structural plate pipe, preparation of a bed on which to lay the structural plate pipe and backfilling of the structural plate pipe.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM A 563M, Carbon and Alloy Steel Nuts
- ASTM F 568, Carbon and Alloy Steel Externally Threaded Metric Fasteners
- ASTM A 568M, General Requirements for Steel, Carbon and High Strength Low Alloy Hot Rolled Sheet and Cold Rolled Sheet
- ASTM A 761M, Corrugated Steel Structural Plate, Zinc Coated, for Field Bolted Pipe, Pipe Arches, and Arches
- CSA G40.20-M, General Requirements for Rolled or Welded Structural Quality Steel
- CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
- CSA G401, Corrugated Steel Pipe Products
- CSA S6, Design of Highway Bridges
- Division 3 Section 2, Gravel Type 1, 1S & 2

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Materials shall be supplied and fabricated in accordance with CSA G401, CSA S6, or ASTM A 761M.

The materials for the bed and backfilling shall conform to Division 3 Section 2 for Type 2 Gravel, referred to hereafter in this specification as structural fill.

## 5.0 CONSTRUCTION METHODS

**5.1 Preparation of Base.** The pipe shall be installed on a prepared base constructed to an elevation set by the Engineer. The base shall be a stable area free of organic matter and large rocks. The area shall be overlaid with a 200 to 300 mm layer of Structural Fill. This layer shall be preshaped in the transverse direction to accommodate the curvature of the pipe. The layer shall be compacted to 95% of Standard Proctor Density, or as directed by the Engineer, except for the portion of bedding in direct contact with the pipe wall. This portion shall be left uncompacted. In general, the area uncompacted shall be the middle 1/3 of the diameter for round pipe and the middle half for pipe arches and

horizontal ellipses.

**5.2 Backfilling/Compaction of Backfill.** Material is not to be dumped on top of the structure but shall be placed in layers starting no closer than 1500 mm from the side walls. Truck end-dumping or dozer placement directly against the sides of the structure shall not be permitted.

Structural fill shall be placed in layers which shall not exceed 200 mm in thickness before compaction. Heavy equipment shall avoid the ends of the structural plate pipe so as to reduce pressure against the end of the barrel.

Fill depth shall be maintained approximately equal on each side of the structure at all times. The maximum difference in elevation shall be 400 mm.

Frozen backfill shall not be used.

Areas close to the pipe shall be compacted using vibrating or tamping equipment running parallel with the length of structure at all times.

Backfill material shall be within  $\pm 2\%$  of optimum moisture content during compaction or as directed by the Engineer.

Each fill layer shall be compacted to 95% of Standard Proctor Density of, or as directed by the Engineer.

When the backfill reaches 3/4 of the rise, all propping inside the structure shall be removed.

When the backfill reaches 3/4 of the rise, spreading and compaction over the top arch shall be made in a direction perpendicular to the length of the structure, i.e. parallel to corrugations, until the finished height of critical backfill zone is reached as shown on the plans.

A minimum layer of 300 mm of backfill shall exist at all times between the spreading equipment and the structure for spans less than 2500 mm. For spans greater than 2500 mm a minimum of 600 mm shall be required. This layer of backfill shall be built up evenly from both sides. The equipment used shall not be heavier than a D-4 caterpillar dozer for spreading material and not heavier than a Buffalo-Bomag BW-75G for compaction.

For a cover greater than 600 mm, the Engineer may permit heavier equipment. Actual sizes of equipment and operating distance from the structure will be determined by the Engineer using information provided by the monitoring of the shape.

**Division 5 Structures****Section 10 Structural Plate Pipe**

The pipe shape shall be maintained during backfilling. The tolerance is  $\pm 2\%$  of the rise for round pipe, arches and horizontal ellipses and  $\pm 2\%$  of the span for vertical ellipses.

If the backfill is not to be placed immediately to the finished road elevation, a wearing and traveling surface shall be built over the critical backfill zone in order to keep the latter operative and adequate to perform its function as a safe structure (or as a soil arch) at all times.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

The shape, at the Engineer's discretion, will be monitored during backfilling and compaction by hanging rows of plumb-bobs on the inside of the pipe.

**7.0 METHOD OF MEASUREMENT**

**7.1 Pipe.** The method of measurement for payment shall be per lineal metre measured along the bottom centerline of the structural plate pipe in place.

**7.2 Foundation Excavation and Structural Fill.** The method of measurement for payment of Foundation Excavation and Structural Fill shall be per cubic metre and per tonne respectively, with the maximum limits as shown on the plans or as directed by the Engineer.

**8.0 BASIS OF PAYMENT**

Structural plate pipe will be paid for at the contract unit bid price per lineal metre for Structural Plate Pipe which price shall include supply of all materials, transportation, erection, labour and all incidentals necessary to complete the work to the satisfaction of the Engineer. The Contractor may be granted partial progress payments, as determined by the Engineer, for materials delivered to the job site.

Payment for Foundation Excavation, Water Control and Structural Fill will be based on the appropriate contract unit bid prices for these items.

**9.0 WARRANTY**

## Division 5 Structures

## Section 11 Aluminum Guard Rail

**SECTION 11 - ALUMINUM GUARD RAIL****1.0 DESCRIPTION**

This section details the supply and erection of the aluminum guardrail as shown on the plans for the structure. Supply of the guard rail shall include the screw anchor inserts and all bolts, nuts, washers, gaskets, and other miscellaneous items required for the completed guardrail system, including posts.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM A 153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- CSA S6-M, Design of Highway Bridges

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

The Contractor shall submit complete shop drawings showing full details of all components of the guardrail system and its assembly to the Engineer for approval before beginning this work.

**4.0 MATERIALS**

The railing shall be fabricated strictly to the requirements and dimensions given in CSA S6-M.

Hi-tensile bolts and round washers shall be hot dipped galvanized to ASTM A 153.

Shims shall be made from a fully annealed alloy known commercially as Alcan 2S or equivalent.

**5.0 CONSTRUCTION METHODS**

Rails and posts shall be erected true to line and levels as shown on the plans or as directed by the Engineer. Rails are to be parallel to each other and to the top of the concrete, and the posts shall be truly vertical. In some cases shims may be required for the alignment of the posts.

The railing shall be of the type as detailed on the drawings.

Surfaces of aluminum in contact with concrete shall be given a heavy coat of alkali-resistant bituminous paint prior to installation. The paint shall be applied as it is received from the Manufacturer without the addition of any thinner.

A prefabricated anchor insert of the type shown on the plans or an approved equal shall be used to secure the bridge railing posts to the concrete. For accurately positioning the insert within the form, a setting template shall be furnished with the insert.

Hi-tensile bolts and round washers shall be given a heavy coating of white non-staining grease.

Nylon Bushings shall be used to prevent any electrochemical reaction occurring between the aluminum posts and the galvanized bolts.

The aluminum bridge railings shall be thoroughly cleaned of all discolouration by approved methods and all marks and scratches occurring during fabrication shall be removed. The Contractor may, at their own expense, apply a thin coat of clear non-yellowing lacquer to the cleaned surfaces, but they shall in any case ensure that the railings, when erected, shall have a clear surface of uniform appearance and texture.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Aluminum guard rail shall be measured for payment by the lineal metre of completed rail system. The quantity for payment shall be the length measured along the line and grade of the top rail along both sides of the structure from end to end of the rail.

**8.0 BASIS OF PAYMENT**

Aluminum guard rail will be paid for at the contract unit bid price per lineal metre of completed rail system installed for Aluminum Guard Rail which price shall include supply and installation of the rail, posts, screw anchors and other accessories forming part of the completed rail system to the satisfaction of the Engineer. The Contractor may be granted partial progress payments, as determined by the Engineer, for materials delivered to the job site.

The Contractor shall be responsible for the aluminum guard rail and all related material during transportation and after delivery to the job site until the completed rail system has been accepted by the Engineer. The Department shall not be liable for the replacement of any parts if such becomes necessary at any time during the contract.

**9.0 WARRANTY**



## Division 5 Structures

## Section 12 Underground Drainage Systems

## SECTION 12 - UNDERGROUND DRAINAGE SYSTEMS

## 1.0 DESCRIPTION

This section details the supply, installation, modification and removal of culvert and storm sewer systems.

Culvert and storm sewer systems shall include all pipe, couplings, catch basins and grates, manholes and covers and any other related material forming an integral part of the system.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- AASHTO M-196, Corrugated Aluminum Pipe for Sewers and Drains
- ASTM F 679, PVC Large Diameter Plastic Gravity Sewer Pipe and Fittings
- ASTM F 794, PVC Large Diameter Ribbed Gravity Sewer Pipe and Fittings
- ASTM F 949, PVC Corrugated Sewer Pipe with a Smooth Interior and Fittings
- ASTM D 3034, Type PSM, PVC Sewer Pipe and Fittings
- CSA-A257.2-M, Standards for Concrete Pipe
- CSA-B182.2, PVC Sewer Pipe and Fittings
- CSA-B182.4, Profile PVC Sewer Pipe and Fittings
- CSA-G401-M, Corrugated Steel Pipe Products
- Division 1 Section 5, Environmental Protection
- Division 2 Section 12, Foundation Excavation
- Division 5 Section 7, Cast in Place Concrete
- Drawing HS506.DWG
- Drawing HS528.DWG
- Occupational Health and Safety Act, Chapter 3 Part 9 Excavation
- UNI-B-5, UNI-B-6, UNI-B-9, Polyvinyl Chloride Pipe

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Cast in Place Concrete Catch Basins** shall be designed to carry a minimum load of 38,500 kg. The design shall be completed by a Professional Engineer acceptable to the Department. Seven copies of the drawings shall be submitted to the Department for approval. No work shall commence until approval is received for the drawings.

## 4.0 MATERIALS

## 4.1 Pipe

## 4.1.1 Reinforced Concrete Pipe. Reinforced

Concrete Pipe shall conform to CSA-A257.2-M. and shall be one of three classes: 65D, 100D or 140D as specified in the contract tender items.

**4.1.2 Corrugated Steel Pipe.** Corrugated Steel Pipe shall conform to CSA-G401-M, except as modified herein. The pipe shall be galvanized or aluminized Riveted Corrugated Steel Pipe or galvanized or aluminized Helical Lockseam Corrugated Steel Pipe.

The nominal wall thickness for Corrugated Steel Pipe shall be as shown in Table 5.12.1.

Table 5.12.1 - Corrugated Steel Pipe

| Dia.<br>(mm) | Wall Thickness (mm)                     |                |            |                           |
|--------------|-----------------------------------------|----------------|------------|---------------------------|
|              | 68 x 13 mm<br>corrugation<br>galvanized | double<br>zinc | aluminized | 125 x 26 m<br>corrugation |
| 300          | 1.6                                     | 1.6            | 1.6        | -                         |
| 400          | 1.6                                     | 1.6            | 1.6        | -                         |
| 500          | 1.6                                     | 1.6            | 1.6        | -                         |
| 600          | 1.6                                     | 1.6            | 1.6        | -                         |
| 800          | 2.0                                     | 2              | 2          | -                         |
| 900          | 2.0                                     | 2              | 2          | -                         |
| 1000         | 2.0                                     | 2              | 2          | -                         |
| 1200         | 2.8                                     | 2.8            | 2.8        | -                         |
| 1400         | 3.5                                     | 3.5            | 3.5        | 2.8                       |
| 1600         | 3.5                                     | 3.5            | 3.5        | 2.8                       |

The couplers shall be corrugated band couplers or universal dimple couplers complete with angle flanges and bolted connectors. Couplers shall be 600mm wide for all pipe sizes. If corrugated couplers are used the pipe ends shall be recorrugated to accept the coupler.

**4.1.3 Corrugated Aluminum Alloy Pipe.** Corrugated Aluminum Alloy Pipe shall conform to AASHTO M-196, except as modified herein.

The nominal wall thickness for Corrugated Aluminum Alloy Pipe shall be as detailed in Table 5.12.2.



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Table 5.12.2 - Corrugated Aluminum Alloy Pipe

| Diameter (mm) | Wall Thickness (mm) |
|---------------|---------------------|
| 300           | 2.0                 |
| 400           | 2.0                 |
| 500           | 2.0                 |
| 600           | 2.0                 |
| 800           | 2.8                 |
| 900           | 2.8                 |
| 1000          | 2.8                 |
| 1200          | 3.5                 |

The couplers shall be corrugated band couplers or universal dimple couplers complete with angle flanges and bolted connectors. Couplers shall be 600mm wide for all pipe sizes. If corrugated couplers are used the pipe ends shall be recorrugated to accept the coupler.

**4.1.4 Polyvinyl Chloride (PVC) Pipe.** Polyvinyl Chloride (PVC) Pipe shall conform to CSA-B182.2, and B182.4; ASTM D 3034, F 679 and F 794 and F 949; and UNI-B-5, B-6 and B-9 as appropriate.

**4.2 Catch Basins and Manholes.** The following or equivalent types shall be considered as acceptable for use:

- Standard 760 mm dia. DOT&PW concrete catch basin (L.E. Shaw SP22) with Industrial Marine Type R361 grating
- L.E. Shaw's SP24, 1050 mm dia. precast concrete catch basin with CP-C18 top, rings as required, and Industrial Marine Type R11, S361D or S401 frame and grate
- L.E. Shaw's SP4, 1200 mm dia. precast concrete catch basin with CP-C18 top, rings as required, and Industrial Marine Type R11, S361D or S401 frame and grate
- Cast in place, block type concrete catch basin with grate designed to carry 38,500 kg (minimum).
- Lawn catch basin: 450 mm pipe, 1.25 m long with bell end up to accommodate a 6.0 mm thick plate steel grate with 25.0 mm diameter holes on a 50.0 mm grid.

Adjustments shall be carried out using the following materials:

- Precast concrete grade rings, minimum depth of 75 mm.
- Cast in place concrete to conform to Division 5 Section 7 of these specifications.
- Grout to be "M-Bed Standard", Emaco S-88", or

approved equivalent and shall be mixed to the Manufacturer's specification.

## 5.0 CONSTRUCTION METHODS

Culvert and storm sewer system materials shall not be ordered for delivery to the site until an approved list is obtained from the Engineer.

Only culvert and storm system materials which have been selected from an approved list shall be ordered for delivery to the site.

## 5.1 Storm Sewer

**5.11 Excavation.** All trenching material shall be piled in a manner that shall not endanger the work area or obstruct sidewalk and driveways or any other area of pedestrian or vehicular traffic. Street drainage and water courses shall be maintained during construction. Hydrants under pressure, valve chamber boxes, or other utility controls shall be kept unobstructed and accessible until the work is completed.

If, at any time during the excavation, it is not possible to place material in its proper location, it shall be stockpiled in approved areas for later use. No extra payment will be considered for the stockpiling or double handling of material.

Caution shall be exercised during excavation work so that the exact location of all buried pipes, services, cables or other underground structures, both known and unknown, may be determined. The Contractor shall be responsible for the repair of such structures when broken or otherwise damaged at their own expense. The Contractor shall also, at their own expense, and in a manner approved by the Engineer, sustain in their place and protect from injury any buried pipes, services, cables, other underground structures, sidewalks, curbs, roadways, buildings and other structures or property in the vicinity of this work. The Contractor shall not be entitled to any claim or extra compensation from, or on account of, the presence of the above or on account of any delay due to the removal, realignment or rearrangement of the same.

Pumps of sufficient capacity shall be provided and kept in operation where necessary to keep the bottom of trenches dry and free from water until the pipe has been installed, inspected and backfilled as directed by the Engineer. Disposal of such water shall not be injurious to public health or private property and shall conform to the requirements of Division 1 Section 5.

**5.12 Excavation Limits.** All trench excavation shall follow the alignment and grade required and shall proceed in advance of pipe laying as directed by the

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Engineer. All work shall be carried out in open trenches with a clear bottom width of not less than 1.0 m or as otherwise directed by the Engineer. In no case shall the width of the top of the trench be less than that shown on Plan HS528. The actual width shall be in accordance with the Occupational Health and Safety Act, Chapter 3, Part 9.

If, during excavation, the material changes from Common to Solid Rock, the Contractor shall excavate the overlying common material and notify the Engineer in order that measurements may be made. No allowance will be made for solid rock excavated before such measurements have been made.

Where the material at excavation grade is unstable, the unsuitable material shall be excavated, replaced with approved material. The material shall be compacted to 95% of Standard Proctor Density, or as directed by the Engineer. Additional excavation will be paid for as detailed in Division 2 Section 12 for actual material removed which payment shall be full compensation for backfilling and compaction of material to replace the unstable material.

If the excavation extends deeper than required, the excavation shall be refilled to the required grade with approved material and compacted to 95% of Standard Density, or as directed by the Engineer, all at the Contractor's expense.

If the excavation extends wider than the maximum limits, a deduction will be made for backfill material required outside these limits.

**5.13 Sheathing and Shoring.** All work done under this section shall be protected in accordance with the relevant requirements of the Occupational Health and Safety Act, Province of Nova Scotia. Where, due to soil conditions or to conform to the Occupational Health and Safety Act, the Contractor is required to use sheathing, shoring or bracing during the trench excavation, such shall be supplied, installed, maintained and removed all at the Contractor's expense. Except where otherwise directed by the Engineer, sheathing shall be withdrawn as backfilling proceeds.

**5.14 Provision for Traffic and Pedestrians.** During the construction of the storm sewer, warning signs, flares, delineators, barricades, etc., shall be placed and maintained at suitable intervals to protect persons from injury and to avoid property damage. These warning signs, flares, etc., shall be maintained until completion of the work.

**5.15 Access to Adjacent Properties.** Access to adjacent properties shall be maintained at all times during the construction period.

**5.16 Laying of Pipe.** Pipe for storm sewer shall be laid as shown on the contract drawings or as directed by the Engineer in accordance with these specifications.

Storm sewer pipe shall be laid to the alignment and grade set by the Engineer. Concrete pipe shall be laid with the bells up and spigot end fully entered into the adjacent bell. Where corrugated metal pipe sections are to be connected, the ends shall be joined together with a coupling made of the same material and size as the pipe. Any pipe not meeting these requirements shall be removed and relaid at the Contractor's expense.

At catch basins the pipe shall be cut so that pipe ends do not project more than 300 mm inside the walls of the catch basin.

**5.17 Bedding.** Storm sewer pipe shall be laid on the bedding prepared and shaped to conform with the exterior bottom of the pipe. Bedding shall be as directed by the Engineer and shall conform to the requirements for Class "B" Bedding as shown on Plan HS506, Bedding Details for Laying Pipe.

Prior to placing of bedding accumulations of water and other objectionable materials shall be removed.

Bedding material shall be compacted to 95% of Standard Proctor Density or as directed by the Engineer.

**5.18 Backfilling.** The Contractor shall supply all labour and equipment necessary for the backfilling of all storm sewer structures and shall do all grading to reestablish excavated areas to the original ground or a specified grade.

Accumulations of water and all other objectionable material shall be removed prior to placing backfill. Granular material used as backfill material shall extend to a height of not less than 300 mm above the top of the pipe.

The backfill shall be carefully placed in layers not more than 200 mm thick, loose depth, and compacted to 95% of Standard Proctor Density, or as directed by the Engineer.

Backfill material placed around the pipe shall be maintained at equal levels on each side of the pipe at all times so that the intended alignment of the pipe is achieved.

The Contractor shall be responsible for any damages arising from improper backfilling procedures.

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**5.2 Culverts.** All the various classes of pipe required for drainage structures shall be furnished and delivered to the project site by the Contractor. Pipe as designated for drainage structures shall be laid on bedding prepared and shaped to conform with the exterior bottom of the pipe. Bedding for pipe culverts shall be as directed by the Engineer and shall conform to the following requirements:

- Class "A" Bedding shall consist of placing the
- culvert pipe in concrete constructed in conformity with the details as shown on plan HS506.
- Class "B" Bedding shall consist of placing the culvert pipe in 100mm layer of crushed stone or gravel constructed as shown on plan HS506.
- Class "C" Bedding shall consist of placing the culvert pipe in an earth foundation shaped and prepared as shown on plan HS506.

Concrete pipe and polyvinyl chloride pipe shall be carefully laid with the bells up grade, spigot-end fully entered into the adjacent bell and true to established lines and grades. Polyvinyl chloride pipe shall be supplied by a plant approved by CSA. If gaskets are supplied separately for polyvinyl chloride pipe, the gaskets shall be inserted in the groove at the bell end of the pipe and the spigot shall be lubricated. The spigot end shall be inserted and pushed up to but not beyond the depth of the stop reference mark. Recesses shall be excavated for any bells involved. Where corrugated metal pipe sections are required to be connected, the ends shall be connected together with a band made of the same material as the pipe. All pipe shall be laid with a uniform slope in the direction of the flow. Any pipe which is not true in alignment, or which shows any settlement after laying, shall be removed and relaid without extra compensation.

Backfill placed around pipe culverts shall be made with layers of approved material deposited on both sides of the culvert to the same elevation at the same time. All materials placed in this operation, over and around the pipe, shall be carefully placed and compacted relative to site conditions and in accordance with required compaction specifications.

**5.3 Catch Basins and Manholes.** Concrete catch basins including grates and manholes including covers, shall be constructed where and as directed by the Engineer.

**5.4 Removals/Adjustments/Repairs**

**5.4.1 Removal of Concrete and Metal Pipe, Catch Basins and Manholes.** Existing Concrete and Metal Pipe, Catch Basins and Manholes shall be removed where and as directed by the Engineer and shall be disposed of or salvaged if possible and shall be re-laid or stored as directed by the Engineer.

**5.4.2 Removal of Driveway Culverts.** Existing steel and concrete driveway culverts shall be removed, salvaged and either installed or stored for future use where and as directed by the Engineer. Used culverts not designated for installation shall be removed and disposed of in a manner approved by the Engineer. No driveway culverts shall be removed without an approved list from the Engineer and only the Engineer will designate which culverts are to be reused and which are to be disposed of.

**5.4.3 Adjustment of Catch Basins and Manholes.** The adjustment of existing catch basins and manholes shall include change in elevation of these structures.

Prior to the adjustment of catch basins and manholes the existing frame and grate or cover shall be carefully removed and salvaged. Any undesirable material used in previous adjustments shall be removed to an elevation as directed by the Engineer.

The use of metal risers, wood, concrete or clay bricks and stone shall not be allowed.

Once the catch basin or manhole has been adjusted, the salvaged frame and grate or cover shall be set on the adjusted structure.

When asphalt concrete or Portland Cement concrete pavement is required to be removed to adjust a structure, the edges of such pavement shall be neatly cut to the satisfaction of the Engineer. All construction debris resulting from adjustment shall be removed from the construction site and disposed of in accordance with Department of the Environment Regulations.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

**7.1 Trench Measurement - Foundation Excavation Common.** The quantity of Foundation Excavation Common shall be based on average end areas calculated at maximum 10 m intervals. For payment purposes the end area at each interval shall be the product of the theoretical trench width, as determined from Plan HS528, and depth. Depth shall be determined by subtracting the theoretical bottom of excavation elevations (including bedding) from the original centerline elevations after grubbing is removed. When it is necessary to remove unsuitable material below the excavation grade, the depth at each interval shall be determined from field measurements.

**7.2 Trench Measurement - Foundation Excavation Solid Rock.** The quantity of Foundation Excavation Solid Rock shall be based on average end areas calculated at maximum 5 m intervals. For payment

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purposes the end area at each interval shall be the product of theoretical trench width, as determined from Plan HS528, and the depth. The depth at each interval shall be determined by subtracting the theoretical bottom of excavation elevations (including bedding) from the original centerline elevations taken on top of the rock.

**7.3 Limit of Excavation.** The limit of trench excavation shall be the point at which the excavation hole for each catch basin or manhole meets the pipe trench (a horizontal distance measured from the centerline of each catch basin or manhole).

**7.4 Pipe.** The quantity paid for pipe shall be the length of pipe in place measured from inlet to outlet. The lengths of coupling devices shall not be added to the length of pipe.

**8.0 BASIS OF PAYMENT**

**8.1 Storm Sewer, Catch Basins and Manholes.** Payment for laying storm sewer pipe will be at the contract unit bid price per lineal metre for Storm Sewer Pipe (of various specified diameters). Payment for installing catch basins and manholes will be at the contract unit bid prices per each for Catch Basins and Manholes (both of various specified diameters). All prices shall include all material, backfilling and compaction of approved excavation or borrow material, disposal of any surplus or unsuitable material and including all plant, equipment, labour and incidentals necessary to complete the work to the satisfaction of the Engineer.

Granular backfill and/or bedding will be paid for in accordance with the tender bid item applicable to that material.

Material excavated per this item will be paid for as either Foundation Excavation Common or Foundation Excavation Solid Rock. Boulders measuring 0.25 m<sup>3</sup> or over, all rock in situ and masonry or concrete of old structures shall be classified as Foundation Excavation Solid Rock, and all other excavated materials shall be classified as Foundation Excavation Common.

**8.2 Culverts.** Payment for laying culvert pipe will be made at the contract unit bid price per lineal metre for Corrugated Aluminum Alloy Pipe, Corrugated Steel Pipe, Polyvinyl Chloride Pipe and Concrete Pipe (all of various specified diameters). This price shall be full compensation for the supply of all material, unloading, transportation charges, laying, preparation of bases, backfilling, compaction of all backfill materials, disposal of surplus materials, water control (unless noted otherwise in the Special Provisions), and also the furnishing of all equipment, tools, plant, labour and

incidentals necessary to complete the work to the satisfaction of the Engineer.

Foundation excavation, non-reinforced concrete and all crushed stone or gravel shall be paid for at the contract unit bid prices for these items.

**8.3 Removals/Adjustments/Repairs**

**8.3.1 Removal of Driveway Culverts.** Removal of driveway culverts will be paid for at the contract unit bid price per lineal metre of pipe removed for Removal of Driveway Culverts which shall be full compensation for the complete removal and disposal or storage of the pipe including all equipment, plant, labour, transportation costs, excavation (see below) and incidentals necessary to complete the work to the satisfaction of the Engineer.

Where the height of cover over the top of a culvert is 2 m or less, excavation required to remove the culvert shall be included in the contract unit bid price. For culverts with more than 2 m of cover, excavation will be paid for according to Division 2 Section 12 of these specifications.

If salvaged culverts are designated for reuse immediately, the work shall be carried out and payment made according to Subsections 5.2 and 8.2 respectively.

**8.3.2 Removal of Concrete and Metal Pipe, Catch Basins and Manholes.** Removal of existing concrete and metal pipe will be paid for at the contract unit bid price per lineal metre for Removal of Concrete Pipe and Removal of Metal Pipe. Removal of catch basins and manholes will be paid for at the contract unit bid price per each for Removal of Catch Basins and Manholes.

All prices shall be full compensation for the complete removal, including excavation quantities and all costs associated with the disposal or salvage of material, including all equipment, plant, labour, transportation and incidentals necessary to complete the work to the satisfaction of the Engineer.

**8.3.3 Adjustment of Catch Basins and Manholes.** Adjustment of catch basins and manholes will be paid for at the contract unit bid price per each for Adjustment of Catch Basins and Manholes which shall be full compensation for locating the structures, neatly saw cutting the asphalt concrete or Portland cement concrete pavement surface, any removal of asphalt concrete or Portland cement concrete pavement, foundation excavation, the supply and placing of all materials used in the adjustment, backfilling with suitable material including compaction, pavement reinstatement, disposal of all construction debris and



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surplus material and all equipment, plant, labour, tools and incidentals necessary to complete the work to the satisfaction of the Engineer.

**8.4 Additional Excavation.** Additional excavation will be paid for as detailed in Division 2 Section 12 for actual material removed which payment shall be full compensation for backfilling and compaction of material

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to replace the unstable material.

If the excavation extends wider than the maximum limits, a deduction will be made for backfill material required outside these limits.

## **9.0 WARRANTY**



## Division 5 Structures

## Section 13 Concrete Restoration

## SECTION 13 - CONCRETE RESTORATION



## 1.0 DESCRIPTION



This section describes repairs to structural concrete excluding prestressed/post tensioned concrete members. It includes but is not limited to bridge decks, abutment walls, pier shafts, backwalls, beam seats, curbs, gutters, parapets, end posts/intermediate posts, fascia, sidewalks and soffits.

## 2.0 REFERENCES

All reference standards shall be the current issue or latest revision at the first date of the tender advertisement. This specification refers to the following standards, specifications or publications:

- ACI 117, Tolerances for Concrete Construction and Materials
- ASTM A 775M, Specification for Epoxy Coated Reinforcing Steel Bars
- ASTM A 820, Specification for Steel Fibers for Fiber Reinforced Concrete
- ASTM C 309, Specification for Liquid Membrane Forming Compounds for Curing Concrete
- ASTM C 881, Specification for Epoxy Resin Base Bonding Systems for Concrete
- ASTM C 1018, Test Method for Flexural Toughness and First Crack Strength of Fiber Reinforced Concrete
- ASTM D 1751, Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
- CSA A23.1, Concrete Materials and Methods of Concrete Construction
- CSA A23.2, Methods of Test for Concrete
- CSA S269.3, Concrete Formwork
- CSA G30.18, Billet Steel Bars for Concrete Reinforcement
- CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction
- Division 4 Section 7, Asphalt Concrete Patching
- Division 4 Section 8, Asphalt Concrete Paving of Bridge Decks
- Division 5 Section 6, Reinforcing Steel
- Division 5 Section 7, Cast in Place Concrete
- Division 5 Section 9, Waterproofing Concrete Bridge Decks
- Environmental Construction Practice
- Occupational Health and Safety Act
- SSPC-SP6, Commercial Blast Cleaning
- SSPC-Vis 1-89, Visual Standard for Abrasive Blast Cleaning

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

For concrete restoration, submissions are governed by the respective referenced standards and the project Special Provisions.

All work conducted at height shall be done in accordance with the latest edition of the Fall Protection and Scaffolding Regulations pursuant to the Occupational Health and Safety Act. The design of scaffolding by a Professional Engineer, as defined and required by this legislation, shall be submitted at the start of construction.



All work shall conform to the Environmental Construction Practice as attached to the approved Water Rights Application. Prior to the start of construction, an on site meeting shall be held to discuss the specific construction format proposed by the Contractor. The meeting shall be attended by the Contractor, Engineer, a representative of the Department of the Environment, and a representative of the Department of Fisheries and Oceans, if required.

## 4.0 MATERIALS

**4.1 Ready Mixed Concrete.** All ready mixed concrete shall be provided in accordance with Division 5 Section 7.

Unless otherwise specified, the specified compressive strength of concrete for repairs shall be 35 MPa and proportioned in accordance with the requirements of Division 5 Section 7.



**4.2 Reinforcing Steel.** Plain reinforcing steel shall be the size specified on drawings and shall be supplied in accordance with CSA G30.18, Grade 400R.

Epoxy coated reinforcing steel shall be used in repair areas where epoxy coated reinforcing steel is encountered. Epoxy coated reinforcing steel shall be Grade 400R and supplied in accordance with ASTM A 775M.

**4.3 Fibres for Secondary Reinforcement of Concrete.** Where indicated, steel fibres shall meet the requirements of ASTM A 820, Type 1, deformed, cold drawn steel wire, and of a minimum tensile strength of 1035 MPa.

Where indicated, polypropylene fibres shall be added to the concrete mixture at the Manufacturer's recommended dosage rate to prevent plastic shrinkage cracks.

The use of fibres in concrete will affect the plastic properties of the concrete and users may find it necessary to use additional admixtures such as superplasticizers to suit the site conditions. The size and dosage of the fibre shall be indicated in the Special

**Division 5 Structures****Section 13 Concrete Restoration****Provisions.**

**4.4 Epoxy Coatings.** Epoxy coatings for field application to plain (uncoated) reinforcing steel shall conform to ASTM C 881, Type IV, Grade 2, Class B and C.

**5.0 CONSTRUCTION METHODS****5.1 Removal of the Existing Asphalt Surface**

**5.1.1. Bridge Approaches.** All damaged pavement in the approaches of the bridge structure, or as otherwise directed by the Engineer, shall be removed. Additionally, the Engineer may direct, in writing, that the highway approaches on either end of the bridge structure be removed to a depth and a distance necessary to adjust for the change of grade, or to otherwise improve ride quality across the bridge. Other than the damaged pavement, only the asphalt concrete required to provide a smooth finished riding surface shall be removed from the approaches. The asphalt concrete shall be removed with a cold planer. The transverse junction between new and old asphalt shall be at an angle approximately 20° to the edge of the pavement. This transverse junction may be achieved by staggered and overlapping passes of the cold planer to create a stepped junction diagonally across the pavement.

**5.1.2 Bridge Deck.** The Contractor shall cut, remove and dispose of the existing asphalt concrete and waterproofing (if any) on the bridge deck. The removal of the pavement and waterproofing membrane from the portland cement concrete deck shall be undertaken in such a manner as to prevent damaging the bridge deck. Any damage to the bridge deck caused by the removal of the existing asphaltic concrete shall be repaired in accordance with the Department's specifications at the Contractor's sole cost. All debris shall be removed completely from the site. Disposal of all debris shall be in accordance with environmental regulations, construction debris disposal bylaws, and in such a manner as to prevent any unsightly appearance from the highway.

**5.2 Concrete Repair**

Prior to concrete removal the quantities outlined by the Contractor shall be verified by the Engineer or his representative employing one or more of the following techniques:

- visual observations
- sounding or chain drags
- half cell survey
- radar techniques

Concrete shall be removed in such a manner as to

prevent damage to adjacent concrete, other components and utilities that are to remain in place. Reinforcing steel, prestressing tendons, shear connectors, structural steel and other components that are to remain in place shall not be damaged or loosened. The Contractor shall ensure that hammers do not come in contact with reinforcing bars in a manner which will cause debonding of bars in adjacent concrete areas not being repaired.

Concrete removal shall not be permitted within 1 m of newly placed concrete for a period of 72 hours.

The Contractor shall prevent contamination, by oil or other deleterious substances, of the concrete surfaces.

The Contractor shall remove all loose and delaminated concrete, as directed by the Engineer. The initial fracturing of the concrete shall be conducted with breaking hammers. Concrete chipping and removal thereafter to the top of the reinforcing steel mat shall be conducted with jack hammers (14 kg maximum). Final determination of the extent of the damaged area shall be made as the work progresses by visual inspection, tapping with a hammer, or half cell. Where the corrosion potential of the reinforcing steel adjacent to the patch perimeter is more negative than -0.350 volts, additional concrete removals may be required by the Engineer. The Contractor shall schedule activities to provide for such surveys, and no claims for delay will be entertained as a result of failure to coordinate with Department forces.

Concrete debris shall be removed completely from the site. Disposal of all debris shall be in accordance with environmental regulations, construction debris disposal bylaws, and in such a manner as to prevent any unsightly appearance from the highway.

Prior to concrete removal the perimeter of the area to be removed shall be sawn (overhead repairs excluded) to a depth of 20 mm or to the depth of the reinforcing steel bar, whichever is less. If additional areas are found after concrete removal the perimeter shall be sawn as indicated above. Reinforcing steel shall not be cut.

The Contractor shall remove concrete to a minimum uniform depth of 20 mm behind the bottom layer of the top mat of reinforcing steel.

Jack hammers shall be used for the removal of concrete in front of and between the reinforcing bars. Only chipping hammers, maximum mass 7 kg, shall be used for the removal of concrete behind and within 25 mm of any reinforcing bars that are to remain and that are located within 100 mm of concrete to remain in place.

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Concrete removal shall extend along the reinforcing steel to the point where it is free from significant rust. Concrete covering the reinforcing steel at the edge of the repair area will be sounded by the Engineer for local delamination before removal operations are completed.

Where the area of concrete removal with exposed reinforcing steel exceeds 2 m<sup>2</sup>, the reinforcing steel shall be retied at every second intersection point and shall be supported to maintain the steel mat in its original location. Supports, shall be approved by the Engineer prior to use, placed as required and tied securely to the reinforcing steel.

**5.3 Abrasive Blast Cleaning**

**5.3.1 Concrete Surfaces.** Abrasive blast cleaning shall only be permitted when the concrete and steel are surface dry.

Areas and components not designated for abrasive blast cleaning and all epoxy coated reinforcing steel shall be protected from adjacent abrasive blast cleaning operations.

The abrasive blast cleaning shall be of such an extent to expose and clean the coarse aggregate and remove all dirt, laitance and hardened concrete slurry. Any oil or grease on the surface of the concrete shall be removed prior to blast cleaning.

The saw cuts at all patch perimeters shall be abrasive blast cleaned to remove all polished surfaces from the cutting operation.

All abrasive debris shall be removed from the patch area with compressed air or high pressure water blasting equipment.

Immediately after abrasive blast cleaning is completed, the Engineer will inspect the cleaned surface for fractured concrete, or loose aggregate. This material shall be removed using hand tools.

Any damage incurred to vehicles or their cargo or injury sustained to their occupants as a direct or indirect result of the Contractor's actions, procedures or negligence shall be the sole responsibility of the Contractor

**5.3.2 Reinforcing Steel.** The full circumference of the existing exposed reinforcing steel shall be cleaned to conform with SSPC-SP6, Commercial Blast Cleaning. Acceptance of the surface preparation will be based on the applicable SSPC surface preparation specification and visual standards given in SSPC-VIS 1.

The placement of the concrete shall be completed within 36 hours of the blast cleaning or the reinforcing steel shall be reblasted.

Only if the original reinforcing steel in the element is protected with an epoxy coating, shall all reinforcing steel be required to be completely recoated with two applications of epoxy or other approved insulating material immediately prior to the placing of the new concrete/mortar. The first coat of epoxy shall be applied prior to the wetting of the concrete surface. The second coat of epoxy shall be in a tacky condition when the new concrete/mortar is placed.

If the original reinforcing steel in the element is found to have suffered substantial corrosion resulting in loss of greater than ten percent of its nominal cross sectional area the Engineer may order the placement of new reinforcing bars or splice to existing bars.

**5.4 Concrete Reinstatement.**

The Contractor shall notify the Engineer 24 hours prior to the time intended to place the patching material. The work shall not proceed until the surface preparation has been inspected by the Engineer.

Hot and cold weather concrete placements shall be conducted in accordance with the respective clauses of Division 5 Section 7.

Patching operations shall be suspended during rain or other climatic conditions which, in the opinion of the Engineer, may adversely affect the quality of the work. Any portions of the concrete patch with incomplete consolidation or finishing shall be removed.

All dust and loose material shall be removed from the prepared surface of the repair area by oil free compressed air before the application of the bonding agent.

Prior to the placement of the concrete, the concrete surfaces to be patched shall be maintained in a wet condition for a period of not less than one hour. Excess water shall be removed from the surface, so as to achieve a saturated surface dry condition, using oil free compressed air immediately prior to application of the bonding agent.

Bonding agents shall be used wherever feasible for concrete patching. Bonding agents shall consist either of a cement/sand grout or a latex modified grout.

The sand/cement grout shall consist of a 1:1 sand/cement mixture mixed to a flowable consistency with a maximum water to cement ratio of 0.40.



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For the latex modified grout, a latex bonding agent shall be added to the sand/cement grout described above. The proportions of cement, sand, latex, and mixing water shall be in accordance with the latex Manufacturer's instructions. No free standing water shall be present in the patch area prior to application of the latex modified bonding agent.

The bonding agent shall be scrubbed into the patch area immediately ahead of the concrete placement. Pockets of excess grout shall be removed.

Concrete placement in the patch areas shall be conducted in accordance with Subsection 5.3 of Division 5 Section 7.

Immediately after placing concrete all surfaces shall be cured in accordance with Division 5 Section 7 of the standard specifications. Bridge deck repairs shall be cured using a layer of polyethylene placed immediately over wet burlap. The Contractor shall be responsible for ensuring that the burlap is kept wet at all times. Deck repairs shall remain covered for a minimum of 72 hours or until a compressive strength of 27 MPa is attained. The curing material shall then be removed and the concrete permitted to air dry for a minimum period of 48 hours prior to waterproofing.

**5.5 Waterproofing Concrete Bridge Decks.**

All waterproofing membrane replacement shall be conducted in accordance with Division 5 Section 9 of these specifications. New waterproofing shall be compatible with existing waterproofing materials.

**5.6 Asphalt Concrete Reinstatement.** Asphalt concrete shall be replaced on the bridge deck in accordance with the requirements of Division 4 Section 8. Other affected areas shall be replaced in accordance with the requirements of Division 4 Section 7.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Quality Assurance.** Concrete testing shall be conducted in accordance with Division 5 Section 7. The efforts of the Department's forces does not augment or replace the Contractor's responsibilities to adhere to the requirements of the specification.

Prior to waterproofing application and after the curing period, all concrete patch areas shall be sounded to detect the presence of any delaminations in the patch concrete. At the Engineer's discretion, further testing may be directed in potentially delaminated areas. Testing may include concrete coring and bond tests in accordance with CSA A23.2-6B-94.

**7.0 METHOD OF MEASUREMENT**

**7.1 Asphalt Concrete Removal.** Asphalt concrete removal at bridge approaches, as described in Subsection 5.1.1, shall be measured by the square metre and based on the original lines and dimensions.

Asphalt Concrete Removal on bridge decks, as described in Subsection 5.1.2, shall be measured as one unit (each) and based on the original lines and dimensions.

**7.2 Concrete Repair of Horizontal and Vertical Surfaces.** Measurement shall be made by the square meter of repaired concrete area based on the original lines and dimensions. On bridge structures the horizontal surface is defined as being those surfaces between the outer edges of the curb, sidewalks or parapet structures. Horizontal surface measurement shall also include vertical faces of the inner edge of the curb, sidewalk and parapet. The areas where deteriorated concrete is removed, up to 150 mm depth, shall be measured and the quantity computed. Any area where the removal of unsound concrete exceeds more than 150 mm into the underlying concrete shall be identified and computed separately. When concrete removal exceeds 150 mm, at intersecting surfaces, only one additional surface shall be measured.

**7.3 Soffit Repairs.** Measurement for concrete repair of deck soffits will be based on the area in square metres of repaired work.

**7.4 Through Repair.** Measurement for concrete through repair of deck topsides, curbs, gutters and medians will be based on the area in square metres of repaired work.

**7.5 End Posts/Intermediate Posts.** End posts/intermediate posts, indicated for replacement, shall be detailed in the Special Provisions and measured as each. The unit price shall be all inclusive to conduct the work described in the Special Provisions.

**7.6 Reinforcing Steel.** Reinforcing steel, where indicated or as directed by the Engineer, shall be measured per kilogram installed. No measurement shall be made for welding of reinforcing steel or mechanical splices or couplings.

**8.0 BASIS OF PAYMENT**

**8.1 Asphalt Concrete Removal.** Removal of asphalt concrete from the bridge approaches will be paid at the contract unit price per square metre, which shall be full compensation for removal and disposal of the old asphalt concrete. Removal of the existing asphalt wearing surface and waterproofing on the bridge deck will be paid at the contract lump sum price and shall be full compensation for removal and disposal of all



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material. The Contractor shall supply all equipment, plant, labour and tools necessary for the cutting, planing, removal, loading and disposal necessary to complete the work.

**8.2 Concrete Repair on Horizontal Surfaces.**

Concrete removal and repair on horizontal surfaces will be paid at the contract unit price per square metre. In addition to this payment item, the Contractor shall be paid at a rate equal to fifty (50) percent of the contract unit price per square meter bid for the area of repairs exceeding 150 mm in depth within the original concrete structure. When concrete removal exceeds 150 mm in depth, payment shall be made for only one of the intersecting surfaces. The payment shall be considered full compensation for the cost of furnishing all materials, aggregates, cement, supplementary cementing materials, water, admixtures, equipment, false work, forms, bracing, labour, curing, surface finish and all other items of expense required to complete the work as shown on the plans and as outlined in the specifications. There shall be no other consideration for payment caused by the depth of repair or degree of difficulty of repair for this work.

Payment includes but not necessarily limited to the following: patch perimeter saw cutting, concrete chipping, removal and disposal, abrasive blast cleaning of the patch and reinforcing, application of bonding agent, forming, concrete reinstatement, and curing.

**8.3 Concrete Repair on Vertical Surfaces (including beam seats).**

Concrete removal and repair on vertical surfaces will be paid at the contract unit price per square metre. In addition to this payment item, the Contractor shall be paid at a rate equal to fifty (50) percent of the contract unit price per square meter bid for the area of repairs exceeding 150 mm in depth within the original concrete structure. When concrete removal exceeds 150 mm in depth payment shall be made for only one of the intersecting surfaces. The payment shall be considered full compensation for the cost of furnishing all materials, aggregates, cement, supplementary cementing materials, water, admixtures, equipment, false work, forms, bracing, labour, curing, surface finish and all other items of expense required to

complete the work as shown on the plans and as outlined in the specifications. There shall be no other consideration for payment caused by the depth of repair or degree of difficulty of repair for this work.

Payment includes but not necessarily limited to the following: patch perimeter saw cutting, concrete chipping, removal and disposal, abrasive blast cleaning of the patch and reinforcing, application of bonding agent, forming, concrete reinstatement, and curing.

**8.4 Soffit Repairs.** Payment for concrete repair of deck soffits will be paid at the contract unit price per square metre and shall be full compensation for the removal, surface preparation, supply of all materials, labour, tools and equipment necessary to complete the repairs to the satisfaction of the Engineer. Soffit repairs will include repair of overhead areas which are formed from the underside of the structure as well as the outside edges of the curb and parapet walls on bridges. **8.5 Through Repair.** Payment for concrete through repair of deck topsides will be paid at the contract unit price per square metre of through repair and shall be full compensation for the removal, surface preparation, supply of all materials, labour, tools and equipment necessary to complete the repairs to the satisfaction of the Engineer. Payments for through repair will apply only to repairs undertaken from the topside. No area of repair will be paid for more than once in any patch.**8.6 End Posts/Intermediate Posts.** End posts/intermediate posts will be paid as each and the unit price shall be all inclusive to conduct the repair as detailed in the Special Provisions.**8.7 Reinforcing Steel.** Reinforcing steel, will be paid on the basis of per kilogram of reinforcing steel installed. No payment will be made for welding of reinforcing steel or mechanical splices or couplings.**9.0 WARRANTY**





## Division 5 Structures

## Section 14 Inextensible Mechanically Stabilized Earth (MSE) Structures (WS)

## SECTION 14 - INEXTENSIBLE MECHANICALLY STABILIZED EARTH (MSE) STRUCTURES - (WS)

### 1.0 DESCRIPTION

The mechanically stabilized earth (MSE) structure shall consist of a non-structural leveling pad, reinforced concrete face panels, and inextensible soil reinforcement elements mechanically connected to each facing panel. Soil reinforcement shall have sufficient strength, frictional resistance and length as required by the design, and as outlined in these specifications.

### 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specification or publications:

- AASHTO Standard Specifications for Highways shall be Sixteenth Edition - 1996 and not the latest revision
- ASHTO M 111, Zinc (Hot-dip galvanized) Coating on Iron and Steel Products
- ASTM A 36/A 36M, Standard Specification for Carbon Structural Steel
- ASTM A 82, Standard Specification for Steel Wire, Plain for Concrete Reinforcement
- ASTM A 123, Standard Specification for Zinc (hot-dip Galvanized) Coatings on Iron and Steel Products
- ASTM A 185, Standard Specification for Steel Welded Fabric, Plain, for Concrete Reinforcement
- ASTM B-663-94, Standard Specification for Silver - Tungsten Carbide Electrical Contact Material
- ASTM A 572/A 572M, Standard Specification for High-Strength Low-Alloy Columbium - Vanadium Structural Steel
- ASTM D 2240, Standard Test Method for Rubber Property - Durometer Hardness
- ASTM D 3080, Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions
- ASTM D 4355, Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water
- ASTM D 4491, Test Methods for Water Permeability of Geotextiles by Permittivity
- ASTM D 4632, Test Method for Grab Breaking Load and Elongation of Geotextiles
- CAN/CSA-S6-88, Design of Highway Bridges
- CSA-A5, Portland Cement
- CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- CSA-A23.2, Methods of Test for Concrete
- CSA-A23.4, Pre-Cast Concrete Materials and Construction
- CSA-G30.12, Bullet - Steel Bars for Concrete Reinforcement
- CSA-G30.16, Weldable Low Alloy Steel Deformed Bars for Concrete Reinforcement

- CSA-G40.21-M87/M92, Structural Quality Steels
- CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles
- Division 1 Section 3, Agreement
- Division 1 Section 5, General Provisions
- Division 2 Section 13, Foundation Excavation for Bridges
- Division 3 Section 10, Fill Against Structure
- Division 5 Section 7, Cast In Place Concrete
- FHWA Publication NO. FHWA-DP.82-1 "Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines"

### 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

It shall be the responsibility of the Design Engineer to provide the following information on the tender plans:

- Plan layout of MSE wall.
- Profiles.
- Developed MSE wall elevations (elevations of top and bottom of wall to be identified) and lengths of MSE walls.
- MSE wall cross-sections showing the supported structures, beam seat configuration, required finished grades, location and slope of surcharge on top of the MSE wall structure.
- Design Parameters:
  - Design Codes
  - Traffic Surcharge (kPa)
  - The magnitude and location of all loads to be carried by MSE Structure
  - Seismic Acceleration Coefficient value (a/g)
- Backfill parameters: (Default design values)
  - Internal angle of Friction for the MSE volume material (minimum 34 degrees), Backfill behind the reinforced soil zone (30 degrees)
  - Foundation Material under MSE Volume (30 degrees)
  - Unit Mass ( $t/m^3$ ) for the MSE volume ( $19 t/m^3$ ) Backfill behind the reinforced soil zone ( $19 t/m^3$ )
- The Allowable Bearing Capacity of the foundation soil under the MSE Volume.
- The total and differential settlement.
- All information on the stability of the foundation soils if slope stability is a concern.

Note: The service life for the MSE structure shall be 100 years.

**3.1 General.** The bidder shall bid one of the approved MSE structures listed in Special Provisions and shall indicate the proposed MSE structure in the bid proposal. The system bid shall be the system built. No substitutions will be allowed. All MSE structures shall be built in accordance with the approved plans and panel shop drawings.

All appurtenances behind, in front of, under, mounted

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upon or passing through the MSE structure such as drainage structures, utilities, piles, footings, or other appurtenances shown on the plans shall be accounted for in the design of the MSE structure and detailed on the MSE structure supplier's drawings.

The MSE structure shall follow the general dimensions of the MSE structure envelope shown on the tender plans. The shop drawings will locate the leveling pad at or below the theoretical leveling pad elevation. The top of the face panels shall be at or above the top of the wall elevation shown on the tender plans.

For MSE Structures with plan curve radii of less than 60 metres, joint details showing panel overhang shall be submitted for the curved wall sections to the Department for review and approval.

**3.2 Fabrication.** The Contractor shall provide design calculations and shop drawings to the Manager of Highway & Bridge Design for review and approval within 2 weeks after the tender award. The Manufacturer of the MSE structure shall not proceed with fabrication until the final approval of the shop drawings. The drawings shall show soil reinforcement type and length; applied bearing pressures; facing panel lay-out; and representative typical details for each section of MSE structure.

**3.3 Testing.** It shall be the Contractor's responsibility to do the required testing and provide to the Manufacturer prior to the design of the MSE structure exact values of unit mass and angles of friction for the Fill Against Structures and the Backfill behind the reinforced soil zone. A copy of this report shall be forwarded to the Design Engineer and to the Department.

The Contractor shall furnish the Department with a Certificate of Compliance certifying that the MSE volume material meets all requirements specified by the Department. Electro - Chemical requirements and gradation requirements are to be as per Division 3, Section 10, Subsection 4.1, 4.2 and Subsection 4.6 MSE Volume Material. Aggregate tests shall be conducted by a testing laboratory approved by the Department. All test results shall accompany the Certificate of Compliance and shall be current and relevant. The Department reserves the right to carry out any additional testing as required at the Department's expense except if such testing reveals work that does not conform with the plans or specifications. In this instance the cost of the testing and the remedial work shall be at the Contractor's expense.

**4.0 MATERIALS**

**4.1 General.** The Contractor shall make their own arrangements with the MSE structure supplier to purchase the necessary premanufactured components required for the MSE structure.

**4.2 Concrete Face Panels and Corner Elements.** Concrete shall have a minimum compressive strength of 30 MPa at 28 days, and shall have a maximum nominal coarse aggregate size of 20 mm, the aggregates used the face panels shall be non-reactive as determined by CSA-A23.2. The maximum water to cementing materials ratio shall be 0.40. The limits for slump and percent air shall be 80 mm  $\pm$  20 mm and 6%  $\pm$  1% respectively. The minimum cementitious content shall be 320 kg. per cubic metre of concrete. Any additives including retarding agents or accelerating agents containing chlorides shall not be used.

**4.3 Panel Reinforcing Steel.** Reinforcing steel shall have a minimum yield strength of 400 MPa and conform to CSA G30.12. Reinforcing cages shall be fabricated with the use of steel wire ties. Tack welding of reinforcement into rigid cages requires the use of CSA-G30.16 weldable grade reinforcement, and shall be in accordance with CSA-A23.4, Subsection 4.2.

**4.4 MSE Structure Components****4.4.1 Inextensible Strip Type Soil Reinforcing Systems**

**4.4.1.1 Reinforcing Strips.** Reinforcing Strips shall consist of hot-rolled, shop fabricated ribbed structural steel conforming to CSA-G40.21 Grade 400W or better or ASTM A 572 grade 65 as shown on the Shop drawings. Galvanizing shall follow shop fabrication and shall be in accordance with CSA-G164 or ASTM A 123. Strips shall be cut to length as shown on the Shop Drawings plus or minus 500 mm.

**4.4.1.2 Tie Strips.** Tie strips shall consist of shop fabricated structural steel conforming to ASTM A 36 or CSA-G40.21 Grade 300W and shall be galvanized in accordance with CSA-G164 after fabrication. Bolt hole alignment, dimensions, and end distances shall be within the tolerances shown on the shop drawings.

**4.4.1.3 Fasteners.** ASTM A 325 bolts and nuts shall be nominal size 12.7 mm diameter hot dip galvanized.

**4.4.1.4 Rubber Bearings Pads.** Panels, except for the bottom coarse, shall be supported on rubber bearing pads. The rubber shall be an elastomer with a Shore Hardness of 85mm  $\pm$  5mm, as measured in accordance with ASTM D 2240.

**4.4.1.5 Filter Fabric.** The filter fabric shall meet the following requirements:

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A non-woven geotextile with a nominal width of 500 mm shall be placed over the inside of all joints between precast panels. These strips of geotextile shall have a minimum overlap of 100 mm at any lap locations. The material shall have the following minimum average roll values:

|                       |            |
|-----------------------|------------|
| Grab Tensile Strength | 530 N      |
| Mullen Burst          | 1655 kPa   |
| Permeability          | 0.22cm/sec |
| UV Resistance         | 70%        |

These requirements for the filter fabric shall be as per ASTM D 4632, ASTM D 3786, ASTM D 4491 or ASTM D 4355 as required.

**4.4.1.6 Structural Connectors.** Structural plate connectors and fasteners used for yokes to connect reinforcements to wall panels around pile or utility conflicts, shall conform to the CSA Structural grades of steel and galvanizing as listed in item 4.4.1.1. Under no circumstances shall field cutting of soil reinforcement be allowed to avoid conflicts in the MSE Volume.

#### 4.4.2 Inextensible Mesh Soil Reinforcing Systems

**4.4.2.1 Reinforcing Mesh.** Reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A 82 and shall be welded into the finished mesh fabric in accordance with ASTM A 185. Bars shall be the same diameter in both directions. Galvanization shall be applied after the mesh is fabricated and shall conform to the minimum requirements of ASTM A 123.

**4.4.2.2 Connection Devices.** Connection Devices shall be fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A 82. Connection devices shall be welded in accordance with ASTM A 185 and galvanized in accordance with the minimum requirements of ASTM A 123.

**4.4.2.3 Connector Bars.** Connector Bars shall be fabricated from cold drawn steel wire conforming to ASTM A 82. Galvanization shall conform to the minimum requirements of ASTM A 123.

**4.4.2.4 Joint Material.** Joint Material shall be a resilient, non-extruding material; uniformly saturated with asphalt, offering a minimum 70% recovery after compression. Joint material shall conform to ASTM D 1751.

**4.4.2.5 Weep Hole Covers.** The weep hole covers shall have a geonet core with a minimum thickness of 6 mm. The polyethylene components shall have a minimum specific gravity of 0.93 cm<sup>3</sup> in accordance with ASTM D 792 and a minimum carbon black stabilization

of 2% in accordance with ASTM D 4218. The geonet core shall be covered on both sides by a geotextile material. The minimum size shall be 250 mm x 250 mm.

**4.4.2.6 Structural Connectors.** Structural plate connectors and fastener assemblies used to connect reinforcing mesh to wall panels around pile or utility conflicts shall conform to CAN/CSA-G40.21 M92 Grade 300W. Galvanization shall be applied after fabrication and shall conform to the minimum requirements of ASTM A 123.

**4.5 Coping Elements.** Where coping elements are required, they shall be cast as shown on the Shop Drawings and in accordance with the requirements of Division 5, Section 7 for Concrete Face Panels and Corner Elements.

**4.6 MSE Volume Material.** The internal angle of friction for the select backfill used in the reinforced fill zone for the internal stability design of the MSE Structure shall not be less than 34 degrees as determined by the Standard Direct Shear Test according to ASTM D 3080. The gradation limits for Fill Against Structure shall be as detailed in Division 3, Section 10 Subsection 4.2 of the Standard Specification.

| ELECTRO-CHEMICAL<br>PARAMETER             | DRY<br>STRUCTURES<br>(above water) | FRESH WATER<br>STRUCTURES<br>(below water) |
|-------------------------------------------|------------------------------------|--------------------------------------------|
| Chlorides (Cl <sup>-</sup> )              | < 100 ppm                          | < 100 ppm                                  |
| Sulphates (SO <sub>4</sub> <sup>-</sup> ) | < 500 ppm                          | < 500 ppm                                  |
| Resistivity                               | > 1000 ohm-cm                      | > 3000 ohm-cm                              |
| pH                                        | 5 - 10                             | 5 - 10                                     |

**4.7 Drainage.** For MSE Structures supporting roadways which are chemically deiced in the winter, an impervious membrane shall be placed below the pavement and just above the first row of reinforcement to intercept any flows containing deicing materials. The membrane shall be sloped to drain away from the facing to an intercepting longitudinal drain outletted beyond the reinforced zone.

#### 5.0 CONSTRUCTION METHODS

Details of heavy equipment such as cranes or off-road trucks to be used during construction or for which the structure is to serve as temporary support, shall be reviewed by the MSE structure designer prior to construction.



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After approval of the shop drawings the Contractor shall provide the Department with 24 hours notice of the intent to fabricate the panels.

The MSE structures shall be constructed in conformity with the lines, grades, details and dimensions shown on the drawings or as established by the Department. The Contractor shall make use of the guidance services provided by the supplier and provide 48 hours notice to the supplier and the Department of the intended date for start of erection.

**5.1 Foundation Excavation.** Excavation for the MSE structure shall be in accordance with the requirements of Division 2, Section 13 and in close conformity to the lines and grades shown on the Drawings.

**5.2 Foundation Preparation.** The foundation for the MSE structure shall be graded level for a width equal to the length of reinforcing strips plus approximately 500 mm or as shown on the shop drawings. Prior to wall construction, the foundation shall be proof rolled and/or compacted to the satisfaction of the Engineer. Any foundation soils found to be unsuitable shall be removed and replaced with a material as approved by the Engineer.

**5.3 Leveling Pad.** Concrete for the non-reinforced concrete leveling pad shall have a minimum 28 day compressive strength of 30 MPa and shall be screeded uniformly smooth with a variation of not more than 5 mm in 3 m. Elevation differences between steps shall not vary more than 5 mm from those shown on the shop drawings. The leveling pad shall be cured in accordance with CSA-A23.1 or as directed by the Engineer.

**5.4 MSE Structure Erection.** MSE Structure erection shall be carried out in accordance with the MSE suppliers recommendations. The Contractor shall provide the Department with a written copy of the MSE supplier's construction manual and any other site specific requirements.

**5.4.1 Panel Erection Tolerances.** The overall vertical tolerance and horizontal alignment tolerance of the MSE structure shall not exceed 20 mm per 3000 mm of wall. The maximum offset between adjacent panel faces shall be in accordance with the following table:

| WALL RADIUS<br>(m) | ALLOWABLE PANEL<br>OVERHANG (mm) |
|--------------------|----------------------------------|
| ∞ (Straight Wall)  | 10                               |
| ∞ to 150           | 15                               |
| 149 to 100         | 18                               |
| 99 to 50           | 25                               |

The fabrication tolerance for alignment of the loop wires and bolt holes of the connection insert shall not exceed 1 mm.

**5.4.2 MSE Volume Material Placement.** MSE Volume Material placement shall closely follow the erection of each row of panels.

The maximum MSE Volume Material lift thickness shall not exceed 250 mm (compacted). Backfill compaction shall be accomplished without disturbance or distortion of reinforcing strips and panels. MSE Volume Material compaction requirements shall be as per Division 3 Section 10 unless otherwise specified by the Engineer. For bridge abutments, particular attention shall be given to compactive effort beneath the bridge seat as outlined on the shop drawings.

Prior to installation of the bridge superstructure the MSE Volume Material placement shall be completed to a level of not less than 900 mm above the foundation level of the bridge seat unless otherwise indicated on the drawings or directed by the Engineer.

The Contractor shall not allow surface runoff from adjacent areas to enter the MSE Structure construction site.

**5.4.3 Reinforcement Placement.** All reinforcement placement shall be as per the appropriate construction manual for the approved MSE Structure.

**5.4.4 Traffic Barrier or Coping Placement.** Pre-cast or cast-in-place traffic barrier or coping, if required on top of the concrete face panels, shall have construction/expansion joints positioned as shown on the shop drawings and shall be cast in accordance with Division 5 Section 7. Mixture design requirements shall conform to Sub-Section 4.2 of this Specification.

**5.4.5 Drainage Pipe Installation.** Perforated drainage pipe shall be installed within the MSE volume behind all MSE Structures. Perforated drainage pipe wrapped in filter fabric shall be installed to the lines and grades shown on the drawings and in accordance with the General Specifications or as directed by Engineer.



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## Section 14 Inextensible Mechanically Stabilized Earth (MSE) Structures (WS)

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

The Contractor shall submit to the Department a detailed Quality Control procedure for panel fabrication. This procedure is subject to Departmental approval prior to fabrication.

Upon approval of the Quality Control procedure the Department reserves the right to carry out Quality Assurance Testing as required.

**7.0 METHOD OF MEASUREMENT**

The preparation of all shop drawings, erection drawings, erection procedures, calculations, etc., shall not be measured for payment but shall be considered as incidental to the work. The supply of any additional materials for the MSE Structure not shown on the drawings, but deemed necessary for the erection shall not be measured for payment but shall be considered as incidental to the work.

The entire MSE Structure on a project excluding the MSE volume material and the foundation excavation shall be measured for payment as one unit for supply and erection.

The MSE volume material shall be measured in accordance with Division 3, Section 10.

Foundation Excavation shall be measured in accordance with Division 2, Section 13.

**8.0 BASIS OF PAYMENT**

MSE Structures will be paid for at the contract lump sum bid price for Mechanically Stabilized Earth Structures which price shall include all labour, equipment and materials required for the supply and fabrication, loading, delivery and erection of the complete MSE Structure and all other incidentals required to complete the job to the satisfaction of the Engineer. All work is to be done in accordance with the plans and the specifications.

The MSE Volume Material shall be paid for in accordance with Division 3, Section 10.

Foundation Excavation shall be paid for in accordance with Division 2, Section 13.

The cost of additional inspection and testing made necessary by the Contractor's work not meeting these specifications shall be the responsibility of the Contractor.

The Contractor may be granted partial progress

payments as determined by the Engineer for this item on the basis of committed materials delivered to the Fabricator's shop and for fabrication satisfactorily completed.

The Engineer's decision as to the value of the work completed for partial progress payments shall be final. Upon payment, the material (before and after fabrication) for which payment has been made shall become the property of the Department with the Contractor assuming full responsibility for safe storage and transport to the construction site.

**9.0 WARRANTY**

Upon completion of the MSE Structure and visual acceptance of the work in accordance with these specifications, a one year maintenance period shall begin. During this period any failure in MSE Structure including, but not limited to, the deficiency of concrete panels and associated components; excess of tolerance on horizontal/vertical alignments; etc. shall be repaired or reconstructed at the Contractor's expense to the satisfaction of the Engineer. Costs associated with labour, materials, transportation, traffic control and any other work required for repair or reconstruction of unacceptable areas shall be paid by the Contractor.

**9.1 Final Acceptance.** The Department or its representative, and the Contractor will meet and inspect the MSE structure one year after the completion of the work. All areas that have failed shall be repaired at the Contractor's expense at no cost to the Department. If the Contractor and the Department do not agree on what areas are failed, the Department's decision shall be final.

The final acceptance of the original MSE structure by the Department shall relieve the Contractor from all maintenance responsibility with respect to the original MSE structure however, the Contractor shall be held responsible to maintain repaired areas for a period of 12 months after repairs are made.

**9.2 Liability.** During the period of construction and the one year maintenance period the Contractor shall be responsible for processing any and all claims for property damage and/or bodily injury caused by the failure of the MSE structure including, but not limited to, motor vehicles or pedestrians. The Contractor shall be responsible for the payment of all property damage and bodily injury claims and agrees to save and hold harmless the Department from all such claims as set out in Division 1 Section 4 Subsection 24 of these Specifications. Claims not handled by the Contractor or his representative efficiently or expediently will be settled by the Department and the costs recovered from the Contractor.

**Division 5 Structures****Section 14 Inextensible Mechanically Stabilized Earth (MSE) Structures (WS)**

**9.3 Warranty Holdback.** Notwithstanding anything to the contrary, as stated in Division 1 Section 3 Subsection 6 of the Standard Specification, the warranty holdback for the MSE Wall will be held and retained by the Minister until the maintenance period has expired. The warranty holdback will be held to ensure that sufficient funds will be available to the Department in the event of non-performance of the

MSE Structure. The Contractor is responsible for all costs including the materials and haul and for the repair of all failures and damages resulting from negligence or faulty workmanship by the Contractor that adversely affects the integrity of the MSE structure which occurs, and is evident prior to, the expiration of the one year maintenance period. The amount of warranty holdback shall be as specified in the Special Provisions.

## Division 5 Structures

## Section 15 Asphaltic Plug Joints

## SECTION 15 - ASPHALTIC PLUG JOINTS

## 1.0 DESCRIPTION

This section details the supply and installation of asphaltic plug joints in the deck from curb to curb and pre-moulded, pre-cut rubber seals and/or polysulfide rubber caulking compound sealant in sidewalk joints from curb to edge of deck.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first day of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D36, Test Method for Softening Point of Bitumen (Ring-in-Ball Apparatus)
- ASTM D113, Test Methods for Ductility of Bituminous Materials
- ASTM D3407, Test Methods for Joint Sealants, Hot-Poured, for Concrete and Asphalt pavements
- ASTM D3583, Methods of Testing Joint Sealants, Hot-Applied, Elastomeric Type, for Portland Cement Concrete pavements, or Joint Sealants, Hot-Applied, Elastomeric, Jet-Fuel Resistant Type, Portland Cement Concrete pavements.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The Contractor shall submit for review three sets of shop drawings for the proposed joint assembly. These shop drawings shall be submitted at least two weeks prior to the start of the project, and shall be specific to the structure identified. All shop drawings shall be approved by the Engineer.

## 4.0 MATERIALS

All materials utilized shall be as per the manufacturers specifications and are to meet with the approval of the Engineer. The following tests shall be conducted on the binder as per the appropriate standard:

Softening Point  
Tensile Adhesion  
Ductility  
Penetration  
Flow  
Resiliency  
Asphalt Compatibility

The aggregate shall meet all manufacturer's requirements with respect to type of stone and gradation requirements.

## 5.0 CONSTRUCTION PROCEDURES

**5.1 Removal of Old Joint Seals.** The existing expansion joint seal assemblies shall be completely removed, including but not limited to steel armoring, steel plates, rubber glands, seals, asphalt concrete, and raised concrete dams. All existing joint seals shall be removed to deck level. Steel re-bar shall be cut off below the level of the deck. Concrete removal incidental to the replacement of redundant existing joint assemblies as well as any delaminated/deteriorated concrete shall be replaced with approved concrete to provide a level surface for the new joint seal. Joint nosings shall be rebuilt to existing openings or as specified by the Engineer. Repair of the concrete under the expansion joint units shall be made in accordance with Division 5 Section 13 - Concrete Restoration.

**5.2 Asphaltic Plug Joints.** Upon completion of the asphalt pavement, the Contractor shall install one of the following asphalt plug joints or approved equivalent in strict accordance with the manufacturer's recommendations:

- Matrix 502
- Fibre-Joint (Visco-Elastic Expansion Joint)
- WABO Expandex
- THORMA Joint System
- KOCH

A manufacturer's representative shall be present during the installation of the joint seal unit and provide the Department, upon completion of the work, with a written report prior to the payment for this item.

**5.3 Sidewalk Joint Sealant.** Expansion joints over curbs and sidewalks shall be sealed with pre-moulded, pre-cut rubber seals and/or two part polysulfide rubberized caulking to the satisfaction of the Engineer. Sealant shall be installed 5 mm below flush with the curb and sidewalks. Expansion joint sealant shall not be installed until concrete deck repairs have been completed adjacent to the joint area. Sealant shall be installed in accordance with the manufacturer's recommendations. A manufacturer's technical representative shall be present during the installation of the joint seal and provide the Department with a written report. The Contractor shall ensure that the area where the rubber sealant abuts the asphaltic plug joint is water tight.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

The Contractor shall provide the services of a technical representative of the joint seal manufacturer during the installation of manufactured assemblies. A written

**Division 5 Structures****Section 15 Asphaltic Plug Joints**

report summarizing the representative's comments and observations shall be provided by the Contractor before final payment is issued. This report shall also describe any deficiencies which may affect the function and warranty of the installed work.

**7.0 METHOD OF MEASUREMENT**

Completed joint assemblies shall be measured on the unit basis and shall include the curb face and sidewalk surfaces of the given structure. The area of the bridge deck within 300 mm on either side of the joint is to be considered part of the joint reinstatement.

**8.0 BASIS OF PAYMENT**

Payment for this item shall be made at the tendered unit price per completed joint assembly. This price

shall include but not be limited to the following: removal and disposal of the old joint seal assembly; supply of the new joint seal assembly; supply and installation of aggregate and binder; rubber sealant; all equipment; materials; labour and incidentals required to complete the work to the satisfaction of the Engineer.

**9.0 WARRANTY**

The Contractor shall warrant complete expansion joint systems applied under the terms of the Contract for a period of 60 months, following the date the work is accepted by the Department, to be free of all defects in materials and workmanship. Any defects found in these systems shall be repaired or replaced by the Contractor to the satisfaction of the Department at no cost to the Department.

## Division 6 Miscellaneous

## Section 1 Traffic Control Persons

**SECTION 1 - TRAFFIC CONTROL PERSONS****1.0 DESCRIPTION**

This section details the placement of Traffic Control Persons (TCP) on contract work for the purpose of warning and directing vehicular traffic while construction operations are being carried out. Traffic Control Persons shall be provided, instructed and supervised by the Contractor. The number of TCP required on any phase of work shall be as directed by the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- DOT&PW, Traffic Control Manual

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

Only persons trained in traffic control procedures and who are accredited by the Department shall qualify as Traffic Control Persons. Training may be done by the Department or any other agency approved by the Department, however, accreditation in all cases shall be based on testing by the Department.

All work carried out by Traffic Control Persons on construction and maintenance projects shall be in accordance with the requirements stated in the Traffic Control Manual.

The Contractor shall be responsible for ensuring that Traffic Control Persons are properly outfitted and equipped as detailed in the Traffic Control Manual.

**4.0 MATERIALS****5.0 CONSTRUCTION METHODS****6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

At the end of each working day the Contractor shall submit a signed copy of Departmental form #168 to the Engineer or Engineer's representative. This form is also to be signed by a Department representative. The Date, Contract Number, Section, Road Name, Construction Activity, Names of Traffic Control Persons and Hours worked by each shall be included.

**8.0 BASIS OF PAYMENT**

The Contractor will be paid at the contract unit price bid per hour per Traffic Control Person for TCP required to provide protection to the traveling public and the workers on such contract work as authorized by the Engineer. The Contractor will be paid for the Traffic Control Persons used only within the limits of the Contract. The Contractor shall be engaged in carrying out a contract bid item of work or approved extra item of work in order to qualify for the payment of Traffic Control Persons. The Contractor's bid price shall be full compensation for supplying of all labour, materials, equipment (except stop/slow paddle and other advance warning signs) and other incidentals necessary to carry out the work described in the aforementioned and to the satisfaction of the Engineer.

**9.0 WARRANTY**





## Division 6 Miscellaneous

## Section 2 Flashing Light Units

## SECTION 2 - FLASHING LIGHT UNITS

## 1.0 DESCRIPTION

This section details the use of Flashing Light Units on contract work. Flashing Light Units (FLU's) shall be used on contract work, day or night as required, to direct traffic out of a lane and to serve as a warning notice during placement and dismantling safety devices, for lane closures and for moving operations.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- DOT&PW, Traffic Control Manual

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

**3.1 Dimensions.** The overall dimension of the FLU shall be a minimum of 145 x 60 cm.

**3.2 Displays.** The FLU's shall have four operating displays:

- Left Arrow
- Right Arrow
- Left and Right Arrow
- Caution Mode (6 or more lights arranged in a pattern, not indicating a direction).

The head of each arrow shall have a minimum of 5 lights.

**3.3 Intensity.** Each light in the unit shall be a minimum 35 watt sealed beam equipped with a visor.

**3.4 Mounting.** FLU's shall be mounted at a minimum height of 2.5 m as measured from the top of the Flashing Light Unit to the road surface.

**3.5 Installation.** The FLU may either be trailer mounted or installed on a service vehicle.

**3.6 FLU's Purchased Before June 1, 1990.** Contractors who had purchased FLU's prior to June 1, 1990 where these units do not comply with the above specifications, shall have written approval from the Department before the FLU can be used on contract work. For FLU's purchased after June 1, 1990, only those that meet the above specifications shall be permitted on contract work.

**3.7 Placement.** Before work is underway, the FLU shall be placed between the workers and the approaching traffic directly in the line of sight of the

approaching motorists.

Notwithstanding the Traffic Control Manual, a FLU shall be required in the placement and dismantling of safety devices on contract work, excepting contract work on low volume roads and urban residential streets (where a 360 degree amber light is sufficient).

**3.7.1 With Traffic Control Persons.** Only the flashing bar shall be used when the FLU is being used in conjunction with Traffic Control Persons.

**3.7.2 Shoulder of Two Lane - Two Way Highway.** Only the flashing bar shall be displayed when the FLU is on the shoulder of a two lane - two way highway.

**3.7.3 Shoulder of Multi-Lane Highway.** Only the flashing bar shall be displayed when the Flashing Light Unit is on the shoulder of a multi-lane highway.

**3.7.4 Lane of Multi-Lane Highway.** Appropriate left or right arrows shall be displayed when the FLU is in a lane of a multi-lane highway. The direction of the arrow indicates the lane approaching motorists are to use to pass the FLU.

**3.7.5 Night Operations.** The intensity of the display shall be reduced during night operations.

## 4.0 MATERIALS

## 5.0 CONSTRUCTION METHODS

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

At the end of each working day the Contractor shall submit a signed copy of Departmental form #168 to the Engineer or representative. This form is also to be signed by a Department representative. The date, Contract Number, Section, Road Name, Construction Activity, the number of Flashing Light Units and the hours worked by each shall be included.

## 8.0 BASIS OF PAYMENT

The Contractor will be paid at the contract unit price bid per hour per Flashing Light Unit required in the placement and dismantling of safety devices and the protection of workers in the work zone on such contract work as authorized by the Engineer. The Contractor's bid price shall be full compensation for all transportation and operating costs (truck and driver if truck mounted) and other incidentals necessary to carry out the above

**Division 6 Miscellaneous**

**Section 2 Flashing Light Units**

work. When the Flashing Light Unit or 360° amber light is used in a signing procedure to reduce the number of advance warning signs then no payment for use of

same will be allowed.

**9.0 WARRANTY**

## Division 6 Miscellaneous

## Section 3 Chain Link Fence

## SECTION 3 - CHAIN LINK FENCE

## 1.0 DESCRIPTION

Chain Link Fence includes the supply and installation of fence fabric, posts and rails, tension wires, gates and all required fittings and accessories.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM F 669, Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence
- ASTM F 1234, Protective Coatings on Steel Framework for Fences
- CAN2-138.1, Fence, Chain Link, Fabric
- CAN2-138.2, Fence, Chain Link, Framework, Zinc Coated Steel
- CAN2-138.4, Fence, Chain Link, Gates
- CSA A23.1, Concrete Materials and Methods of Concrete Construction
- Drawing HS602.DWG
- Drawing HS603.DWG
- Drawing HS604.DWG

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Fence Fabric.** The steel wire for Chain Link Fence shall conform to CAN2-138.1. The fabric shall be 1.8 m wide with a uniform 50 mm diamond pattern chain link mesh closed at one edge by knuckling and at the other edge by twisting to form a barb. The wire shall be Type 1 Steel Fabric Class A Grade 2 Zinc Coated 3.5 mm diameter steel wire of one of the following types:

- Steel wire, hot-dip galvanized after weaving
- Steel wire, electro-galvanized.

**4.2 Posts and Rails.** Posts and rails shall be of Type A or Type B, at the discretion of the supplier. Type A posts and rails shall be of galvanized steel pipe, schedule 40, conforming to CAN2-138.2. Type B posts and rails shall be steel pipe conforming to ASTM F 669. Protective coatings for Type A and Type B Posts and Rails shall conform to ASTM F 1234. The Dimensions of framework members shall be as shown in Table 6.3.1.

Table 6.3.1 - Dimensions of Posts and Rails

| Component                                   | Pipe Size O.D.<br>mm | Length<br>mm |
|---------------------------------------------|----------------------|--------------|
| Posts, end,<br>corner gate and<br>straining | 89                   | 2900         |
| Posts, line                                 | 60                   | 2650         |
| Rail, top and<br>brace                      | 42                   | random       |

For fabric widths other than 1.83 m, the length of the posts shall be increased or decreased by the amount of the difference in fabric width.

**4.3 Tension Wires.** The diameter of the bottom tension wire shall be 5.0 mm or heavier, single strand galvanized steel wire.

**4.4 Gates.** Gates shall be supplied in accordance with the drawings in sizes defined as the distance between the inside faces of the gate posts. Gates shall be constructed from 42 mm O.D. galvanized steel pipe frames and 32 mm O.D. galvanized steel pipe braces, both conforming to the requirements of CAN2-138.4. Steel Pipe used in gates shall match that used in fence framework. All joints shall be electrically welded and hot-dip galvanized after welding, or otherwise treated by a procedure approved by the Engineer to provide equivalent protection. All gates shall be supplied with galvanized malleable iron hinges, latch and latch catch and shall be capable of opening approximately 180°. Double gates shall have a chain hook to hold gates open and a center rest with drop bolt for the closed position. Gate latches shall be fitted for the use of padlocks which can be attached and operated from either side of the gate. Gates shall be supplied completely assembled, including the fabric. Gate fabric and installation shall be the same as for adjacent chain link fence.

**4.5 Fittings and Accessories.** All required fittings and accessories and galvanizing of such material shall conform to CAN2-138.2 and CAN2-138.4. All posts shall be fitted with waterproof caps designed to fit and fasten securely over the posts and carry the top rail. Fasteners for attaching fence fabric to posts, bottom wire and top rail shall be 3.5 mm diameter aluminum or galvanized steel wire or 1.5 mm stainless steel wire. Stretcher bars shall be 5 x 19 mm galvanized steel. Stretcher bar fastening bands shall be at least 3 x 19 mm galvanized steel or 5 x 19 mm aluminum.

**Division 6 Miscellaneous****Section 3 Chain Link Fence**

**4.6 Zinc Coating.** Zinc coatings shall conform to CAN2-138.1, CAN2-138.2, CAN2-138.4 and ASTM Designation F 1234.

**5.0 CONSTRUCTION METHODS**

**5.1 Grading.** Prior to the erection of the chain link security fence the Contractor shall remove any debris and correct minor ground undulations so as to obtain a smooth uniform gradient. The Contractor shall cut off at ground level, such trees, stumps and bush and remove and dispose of such logs, debris and overhanging branches as would interfere with the erection of the fence. After fence erection the Contractor shall clean and trim the site, replace sod disturbed by fencing operations, and restore the ground to a neat condition satisfactory to the Engineer.

**5.2 Posts.** Post spacing shall be at equal horizontal distances where possible and shall not exceed 3 m. All posts shall be placed in a vertical position and set accurately to line and position as established by the Engineer. Straining posts shall be installed at equal intervals not exceeding 150 m. Additional straining posts shall be installed as directed by the Engineer where there are appreciable changes in vertical alignment. Horizontal deflections of 10° or more shall be considered as corners and corner posts shall be installed. Posts in earth, shale, loose and friable rock, or where overburden is 600 mm or greater shall be set in concrete footings of the depth and dimensions shown in the contract drawings, even if blasting is required. In such cases, where the size of the hole exceeds the minimum dimensions of the footings as shown on the contract drawings, the Contractor shall either place the footing against undisturbed soil or shall backfill the hole with suitable earth material compacted to a density of 95% of maximum dry density or as directed by the Engineer and then bore a hole to the required minimum dimensions. In solid rock or where overburden is less than 600 mm, holes for posts shall be drilled in the rock to a minimum depth of 400 mm with a diameter of 25 mm greater than the outside diameter of the post. The annular space around the post shall be filled with either cement grout or hot poured sulphur. Posts shall be cut to the required height above ground so as to present a smooth and uniform gradient.

**5.3 Concrete Footings and Concrete Gate Rests.** Concrete footings and gate rests shall be rough cast in the ground and domed above grade to shed water. Concrete shall conform to CSA A23.1 for 25 MPa Concrete. Fence fabric shall not be installed until the concrete footings have cured for a period of not less than 5 days.

**5.4 Bracing.** End and gate posts shall be braced to

the nearest line post by means of a pipe brace placed near the top of the end post and sloped diagonally to the bottom of the line post to form a brace panel. Corner and straining posts shall be supported with diagonal braces placed on both sides of the post.

**5.5 Pipe Rails.** Pipe rails shall be attached to the tops of the posts by means of waterproof caps which shall be fastened securely over the posts.

**5.6 Tension Wire.** The bottom tension wire shall be stretched tight and securely fastened to end, corner, gate or straining posts with drop-forged tumbuckles and stretcher bar bands.

**5.7 Fabric.** The fence fabric shall be erected such that the space between the ground and bottom of the fabric shall not be less than 40 mm and shall not exceed 80 mm. The fabric shall be stretched tight with the knuckled edge at top and securely fastened to end, corner, gate and straining posts with steel stretcher bars and steel or aluminum stretcher bar bands, spaced at 300 mm intervals. The fabric shall be placed on the side of the post nearest the roadway, except where otherwise directed by the Engineer. The fabric shall be securely fastened to the pipe rail and bottom tension wire with tie wires at 0.50 m intervals, and to the line posts at 0.35 m intervals. The tie-wires on the bottom tension wire shall have not less than 2 twists.

**5.8 Gates.** Both single and double gates shall be hung with the fastenings provided in conformity with the contract drawings. Gates shall be hung approximately 40 mm above the ground.

**5.9 Damage to Zinc Coating.** All abraded and damaged galvanized surfaces shall be cleaned and painted. Damaged areas shall be thoroughly wire brushed and all loose and cracked spelter coating removed, after which the cleaned area shall be painted with two coats of a zinc pigmented paint approved by the Engineer for this purpose.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

**7.1 Chain Link Security Fence.** Measurement for chain link security fence shall be made in metres, following the contour of the ground, of the actual length of fence erected and shall include the length of brace panels.

**7.2 Gates.** Measurement for gates shall be made of the actual number of openings in the fence for gates, regardless of the size and type of gate erected. Double gates shall be counted as one gate.



**Division 6 Miscellaneous****Section 3 Chain Link Fence****8.0 BASIS OF PAYMENT**

**8.1 Chain Link Security Fence.** Payment will be made at the contract price per metre for the supply and erection of the fence, line posts, end posts, corner posts, gate posts, and straining posts regardless of the nature of the material in which the posts are set. Such payment shall be full compensation for the preparation of the site, the disposal of debris, the construction of the concrete footings, the cutting of line posts where necessary, the tying into existing chain link fences, and the restoration of the site to a neat condition all to the satisfaction of the Engineer.

**8.2 Gates.** Payment at the contract price per opening shall be full compensation for the supply and erection of each size and type of gate together with the necessary fittings and hardware, and including the construction of the center rest in the case of double gates all to the satisfaction of the Engineer.

**8.3 Repairs.** The cleaning of the damaged areas and the supply and application of paint shall be at the Contractor's expense.

**9.0 WARRANTY**



## Division 6 Miscellaneous

## Section 4 Right-of-Way Fence

**SECTION 4 - RIGHT-OF-WAY FENCE****1.0 DESCRIPTION**

Construction of the Right-of-Way Fence includes the supply and erection of a fence composed of wooden posts and galvanized wire, either in five strands unwoven or in seven strands woven mesh, with steel gates where directed, all in accordance with the plans and as specified herein.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Drawing HS601.DWG

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

**4.1 Posts.** The posts shall be of straight and sound juniper, spruce or other approved wood material. The bark shall be entirely removed and all knots hewn flush with the face. Gate, end and corner posts shall be at least 2.2 m long and shall have a minimum top size of 175 mm diameter or 150 mm square. All other posts shall be at least 2 m long and shall have a minimum top size of 125 mm.

**4.2 Wire for Fencing and Gates.** The base metal shall be of an approved commercial grade of steel wire. All wire shall be galvanized. The size of the galvanized wire shall be not less than gauge nine (9) (British Imperial Standard Wire, nominal diameter of coated wire, 3.658 mm). Seven-strand woven mesh fencing shall consist of seven longitudinal wires with vertical stay wires spaced not more than 560 mm apart. The spacings of the longitudinal wires (commencing at the bottom) shall be 150, 150, 175, 230, 255, and 255 mm or other approved spacing. Longitudinal vertical wires shall be fastened together at the intersections with approved locks. All longitudinal wires in both types of fencing shall be of coiled spring or other approved type.

**4.3 Gates.** Gates shall be galvanized tubular steel frames, 1200 mm high, the length to be as directed by the Engineer. The frame shall be filled with woven

galvanized wire mesh consisting of six or more longitudinal wires, and of vertical wires spaced not more than 380 mm apart fastened together at all intersections as directed by the Engineer. Tubular steel braces shall be placed vertically at the third points in gates 3 m in length or longer. Corner and brace joints in the gate frame shall be so secured that the gate will retain a true rectangular shape. Each gate shall be fitted with two hinges and one latch.

**5.0 CONSTRUCTION METHODS**

Right-of-way wire fences, Type "A" (unwoven five strand), Type "B" (woven mesh seven strand) and right-of-way fence steel gates shall be erected complete in accordance with the plans and as specified herein. All wire shall be stretched taut and all posts set plumb and firmly embedded. Posts at grade depressions and corners wherever directed by the Engineer shall be guyed to a log deadman as shown on plan. All posts shall be cut off to uniform height and the finished fence shall be true to line and rigid throughout.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Right-of-way wire fences Type "A" and Type "B" and steel gates placed to the satisfaction of the Engineer shall be measured separately by the metre complete in place. The length of a gate shall be the clear opening between gate posts.

**8.0 BASIS OF PAYMENT**

Payment will be made for the fences and gates measured as herein specified at the contract unit prices bid per metre for Right-of-Way Wire Fence Type "A", Right-of-Way Wire Fence Type "B" and Right-of-Way Fence Steel Gates, which prices shall be full compensation for the furnishing of all materials and erection of same and all labour, equipment, tools, excavation and disposal of surplus materials and all incidentals necessary to complete the work all to the satisfaction of the Engineer.

**9.0 WARRANTY**



## Division 6 Miscellaneous

## Section 5 Removal of Existing Sidewalks, Driveways and Curbs

**SECTION 5 - REMOVAL OF EXISTING SIDEWALKS, DRIVEWAYS AND CURBS****1.0 DESCRIPTION**

This section details the requirements for removing and disposing wholly or in part, of Asphalt Concrete or Portland Cement Concrete sidewalks, curbs, driveways and curbs and gutters.

**2.0 REFERENCES****3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

**5.1 Cutting.** Where a section of Asphalt Concrete or Portland Cement Concrete sidewalk, curb, driveway or curb and gutter is to be removed either as part of the removal of sidewalk, curb, driveway or curb and gutter, then the Contractor shall first saw cut the curb, curb and gutter, driveway or sidewalk along the lines as designated by the Engineer.

The saw cuts shall be made straight and vertical and made in such a manner that shall allow neat butt joints with future new concrete.

**5.2 Demolition and Removal.** Demolition and removal of sidewalks, driveways, curbs and curbs and gutters shall be carried out in such a manner and with such equipment, so as not to disturb sections that are to remain. No explosives shall be used.

**5.3 Disposal of Waste Material.** Waste materials shall be removed and disposed of in an approved waste disposal area provided by the Contractor at their own expense or in an area approved by the Engineer. This area shall be left in an environmentally acceptable condition.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

**7.1 Curbs and Curbs and Gutter.** Quantities for removal of Asphalt Concrete and Portland Cement Concrete Curb, and Curb and Gutter shall be by the length in metres, rounded to one decimal place, as measured along the exposed face of the curb before excavation.

**7.2 Driveways and Sidewalks.** Quantities for removal of asphalt concrete and portland cement concrete sidewalks and driveways shall be measured in square metres rounded to one decimal place.

Measurements shall be made before removal and shall be the surficial area calculated as the product of the width of sidewalk times its length.

**8.0 BASIS OF PAYMENT**

**8.1 Curbs and Curbs and Gutter.** Payment for complete removal of Asphalt Concrete or Portland Cement Concrete Curbs, and Curbs and Gutter will be made at the contract unit price bid per metre which price shall be full compensation for the supply of all equipment, plant, labour and incidentals necessary to neatly saw cut, demolish, excavate, load, transport, dispose of waste material and any other incidentals necessary to complete the work all to the satisfaction of the Engineer.

**8.2 Driveways and Sidewalks.** Payment for complete removal of Asphalt Concrete or Portland Cement Concrete Driveways and Sidewalks will be made at the contract unit price bid per square metre which price shall be full compensation for the supply of all equipment, plant, labour and incidentals necessary to neatly saw cut, demolish, excavate, load, transport, dispose of waste material and any other incidentals necessary to complete the work all to the satisfaction of the Engineer.

**9.0 WARRANTY**





## Division 6 Miscellaneous

## Section 6 Non-Coning Traffic Paint

## SECTION 6 - NON-CONING TRAFFIC PAINT

## 1.0 DESCRIPTION

Non-Coning Traffic Paint shall consist of the supply and application of paint to produce longitudinal pavement markings including road centerline, lane divider and edge lines as required and the supply and application of overlay-type glass beads.

## 2.0 REFERENCES

All reference standards shall be the current issue or latest revision at the earliest date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 711, Test Method for No-Pick-Up Time of Traffic Paint
- ASTM D 868, Test Method for Evaluating Degree of Bleeding of Traffic Paint
- ASTM D 969, Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint
- ASTM D 1155, Test Method for Roundness of Glass Spheres
- ASTM D 1210, Test Method for Fineness of Dispersion of Pigment-Vehicle Systems
- ASTM D 1214, Test Method for Sieve Analysis of Glass Spheres
- ASTM D 1309, Test Methods for Settling Properties of Traffic Paints During Accelerated Storage
- ASTM E 97, Test Method for Directional Reflectance Factor of Opaque Specimens by Broad-Band Filter Reflectometry
- CGSB Specification 1-GP-71, Refractive Index
- DOT&PW, Traffic Control Manual.
- Transportation Association of Canada, Manual of Uniform Traffic Control Devices For Canada.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

A 1 l sample of each of the yellow and white paint, in sealed air tight containers, and a 25 kg bag of the reflectorizing glass beads shall be submitted to the Department by the Contractor for testing, no later than three weeks prior to the start of work under the contract.

## 4.0 MATERIALS

## 4.1 Paint.

4.1.1 General. The paint shall have the following properties:

- be homogeneous and the pigments well dispersed to a smooth uniform consistency
- not skin, thicken, gel, cake or show settlement for a minimum of six months from the time of delivery
- be free of dirt and other foreign particles which may

cause difficulty with spray gun or equipment at the elevated application temperatures

- flow smoothly and evenly and completely obliterate in one coat when applied to the pavement at the intended wet film thickness
- be flat in sheen and provide the maximum brightness and visibility with or without the overlay glass beads under daylight and artificial light
- not darken or change in service so as to impair or change the colour and visibility of the stripes other than that caused by normal traffic wear.
- when overlay glass beads are applied at the rate of 700 g/L of paint, proper retentative anchorage shall be provided by the paint.
- be suitable for spray application to portland cement concrete and asphalt cement concrete pavement when heated to between 70°C and 90°C.
- dry quickly enough so that traffic cones are not required to direct vehicles from paint to avoid tracking.

4.1.2 Delivery and Packaging. The paint shall be furnished in clean, open head, 205 L drums, 18-20 gauge steel, with 8 mil disposable plastic liners. Drums shall be airtight when sealed.

Each drum shall be clearly marked with:

- paint colour
- name of product
- date of manufacture
- Manufacturer code and batch number
- Manufacturer's name and address
- safety marks as specified by the Transportation of Dangerous Goods Act and Regulations.

Disposal of empty containers according to Environmental Regulations shall be the responsibility of the Contractor.

4.1.3 Properties of Non-Coning Paint. The properties of non-coning paint shall conform to the requirements listed in Table 6.6.1.

## 4.2 Glass Overlay-Type Beads

4.2.1 General. The beads shall be true spheres and their surface shall be smooth, lustrous and free from cavities and scratches. The beads shall be manufactured from glass of a composition designed to be resistant to the effects of traffic wear and weathering. No foreign material shall be contained in or among the beads.

4.2.2 Colour. The glass beads shall be colourless to the extent that they do not impart a noticeable hue to the paint.

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## Section 6 Non-Coning Traffic Paint

Table 6.6.1 Non-coning Traffic Paint Properties

| Property                                                  | Specification |     | Test Method <sup>(1)</sup>           |
|-----------------------------------------------------------|---------------|-----|--------------------------------------|
|                                                           | Min           | Max |                                      |
| General                                                   |               |     |                                      |
| Density                                                   | -             | -   | Method 2.1                           |
| Consistency, KU <sup>(2)</sup>                            | 85            | 95  | Method 4.5                           |
| Skinning Properties <sup>(3)</sup>                        | 0             | 0   | Method 10.1                          |
| Hiding Power, m <sup>2</sup> /L                           | 8.4           | -   | Method 14.2                          |
| Volatile Matter, %                                        | -             | 28  | Method 17.1                          |
| Pigment Content, % <sup>(4)</sup>                         | 52            | 59  | Method 21.2                          |
| Phthalic Anhydride Content, %                             | 37            | -   | Method 57.1                          |
| No-pick-up time, min <sup>(5)</sup>                       | 1             | 8   | ASTM D 711                           |
| Fineness of grind, HU                                     | 3             | -   | ASTM D 1210                          |
| Bleeding                                                  | 4             | -   | ASTM D 868<br>ASTM D 969             |
| Settling Rate                                             | 6             | -   | ASTM D 1309                          |
| White Paint                                               |               |     |                                      |
| Titanium Dioxide, g/L                                     | 150           | -   | Method 2.1,<br>21.1, 50.14           |
| Reflectance                                               | 80            | -   | ASTM E 97                            |
| Colour                                                    | -             | -   | 1-GP-12C-513-301                     |
| Yellow Paint                                              |               |     |                                      |
| Titanium Dioxide, g/L                                     | 75            | -   | Method 2.1,<br>21.1, 50.14           |
| Medium Chrome Yellow, g/L (87% min lead chromate content) | 100           | -   | Method 2.1,<br>21.1, 50.14,<br>50.19 |
| Reflectance                                               | 60            | -   | ASTM E 97                            |
| Colour                                                    | -             | -   | 1-GP-12C 505-308 (approx)            |

<sup>(1)</sup> All tests to be performed by methods as per (CGSB) 1 - GP-71 or American Society of Testing and Materials (ASTM) or as noted herein.

<sup>(2)</sup> Krebs units at 25°C.

<sup>(3)</sup> Paint shall be non-skinning.

<sup>(4)</sup> By mass of pigment wet.

<sup>(5)</sup> Also, field tests on a 255 µm wet film thickness of hot spray (70°C - 90°C). Wait one minute, drive a

passenger vehicle over the film and no visible (from 15 m) deposition of paint is deposited onto the adjacent pavement.

**4.2.3 Refractive Index.** The index of refraction of the glass beads shall not be less than 1.50 when tested in accordance with method 49.1 of CGSB Specification 1-GP-71.

**4.2.4 Roundness.** A minimum of 75% by mass of the glass beads shall be true spheres. The percentage of true spheres shall be determined by one of the following methods:

- by counting the beads under 50X and 100X magnification as follows:
  - Glass beads larger than #50 sieve size inclusive shall be counted under 50X magnification (see gradation requirements).
  - Glass beads smaller than #50 sieve size shall be counted under 100X magnification.
  - Approximately 1000 beads contained loosely in a culture dish shall be counted under reflected light for each sieve specified to determine the percentage by mass of perfectly round spheres.
- by ASTM D 1155.

Failure to meet roundness requirements by either method will be cause for rejection.

**4.2.5 Imperfections.** The surface of the beads shall be smooth, lustrous and free from film scratches and pits. Not more than 25% of the true spheres shall have imperfections in the form of milkiness, air inclusions, dark specks and incipient fractures. These properties shall be determined using method 149.1 of CGSB Specification 1-GP-71.

**4.2.6 Gradation.** The glass beads shall meet the following gradation requirements:

Table 6.6.2 - Gradation

| Sieve Opening, µm | Percent Passing |
|-------------------|-----------------|
| 850               | 100             |
| 600               | 80 - 100        |
| 300               | 20 - 35         |
| 150               | 0 - 8           |
| 75                | 0 - 2           |

Tests for gradation shall be made in accordance with ASTM Standard D 1214. The sample size shall not be less than 50 g or more than 100 g.

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**4.2.7 Moisture Resistance.** The beads shall not agglomerate during storage and application. They shall be treated in such a manner as to overcome the effect of water, both as a vapour and a liquid, on the beads before the beads are added to the paint stripe. They shall flow freely from dispensing equipment at any time when surface and atmosphere conditions are satisfactory for painting. Moisture resistance shall be tested by the method described as follows:

A 100 g sample of glass beads shall be placed in a 500 ml beaker and an equivalent volume of distilled water shall be added to the beaker. The beaker shall then stand for 5 minutes at the end of which time the water shall be carefully poured off and the glass beads transferred to a clean dry beaker and allowed to stand for 5 minutes. The beads shall then be poured slowly into a standard 125 mm glass funnel having a stem of 125 mm length and 10 mm inside diameter.

The beads shall flow through the stem without stoppage. Slight initial agitation to start the flow through the funnel at the beginning of the test is permissible.

**4.2.8 Chemical Stability.** When the glass beads are exposed to atmospheric conditions, humidity, diluted acid or alkali solutions or paint film constituents, there shall be no dulling of the surface which would adversely affect reflective properties of the beads.

Calcium chloride resistance shall be determined in the following manner:

- Place 10 g of beads in a 100 ml beaker;
- Cover the sample with 500 ml of calcium chloride (1.0 Normal Solution);
- Let the beads soak for three hours;
- Rinse the beads three times with 100 ml of distilled water and dry;
- Examine the beads under a microscope and compare them with an untreated sample.

Dulling of the surface or other detrimental effects shall constitute failure of this test.

**4.2.9 Packaging.** The glass beads shall be furnished in clean, durable, waterproof bags containing 25 kg each. Bags shall be of one of the following types:

- woven polypropylene, lined inside with a sprayed polyethylene coating of 0.25 mm thickness
- 10-oz jute, with polyethylene liner of 0.50 mm
- 50 lb basis weight, multi-walled kraft paper, with polyethylene liner of 0.50 mm thickness.

These bags shall be able to withstand handling and storage between packaging and application of the beads, and shall be constructed so as to avoid contamination of the beads with foreign materials. Both

ends of the bags shall be securely sealed to prevent leakage.

Bags of glass beads shall be supplied on non-returnable wood pallets, 40 - 60 bags per pallet, and shall be lashed or secured to the pallet.

Each wooden pallet shall be clearly marked as to:

- name of product;
- date of packaging;
- Manufacturer's code and batch number;
- Manufacturer's name and address.

## 5.0 CONSTRUCTION METHODS

**5.1 Equipment.** The Contractor shall supply a highway striping truck which is capable of striping centre, lane and edge lines and of applying overlay-type glass beads to the wet painted line by means of pressurized bead dispensers. The truck shall be fitted with a paint heater capable of heating paint to any temperature up to 80°C and maintaining a constant temperature during spraying operations.

**5.2 Painting Operations.** Traffic line painting shall include centerline painting, lane line painting and edge line painting.

The term centerline shall be used to describe any of the standard line combinations separating opposing traffic lanes on two-lane, two-way traffic highways and shall include the following:

- Single skip lines
- Single skip and single solid lines
- Double solid lines
- Single solid line (Occasionally a narrow local low volume road may have a single solid centerline).

All such centerlines shall be yellow in colour.

The term lane line shall be used to describe any line separating lanes of traffic travelling in the same direction and may be either a single white skip line or a single white solid line.

The term edge line shall be used to describe any line which defines the shoulder edge of the outside traffic lanes. On two-lane highways, edge lines shall be white in colour. On divided highways the edge line on the right in the direction of traffic flow shall be a single solid white line, the one on the left a single solid yellow line.

The width of painted lines shall be 11.5 cm. Paint shall be heated to a temperature sufficient to enable it to dry when applied to the road, in a time frame short enough to avoid the use of traffic cones for protection of vehicles and the painted line itself. Paint shall be applied at a rate to achieve in one pass a minimum dry



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film thickness (dft) of 255  $\mu\text{m}$ . Overlay-type reflectorizing glass beads shall be dispensed from the paint striping truck by means of a pressurized bead dispenser to the wet painted line at the rate of 700 g/L of paint applied.

All lines are to be true with clearly defined edges and without noticeable overspray of adjacent road surfaces.

No painting shall be carried out when visible moisture is present on the road surface.

Lines not painted in accordance with these specifications shall be repainted by the Contractor at the expense of the Contractor.

The Contractor shall inform the Department's representative on the job of the Contractor's daily schedule to enable the representative to be present as they deem it necessary during loading and painting operations.

**5.3 Traffic Control.** Traffic Control shall be the responsibility of the Contractor and shall be carried out in accordance with the DOT&PW Control Manual.

**5.4 Traffic Lines.** Line markings shall be in accordance with the Transportation Association of Canada's Manual of Uniform Traffic Control Devices For Canada, Figure C-1.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Sampling and Testing Paint.** A one litre sample of each of the yellow and white paint, in sealed air tight containers, and a 25 kg. bag of the reflectorizing glass beads shall be submitted to the Department by the Contractor for testing, no later than three weeks prior to the start of work under the contract. Once the Contractor has selected the paint and glass bead suppliers and the Department has approved the materials to be used, the Contractor shall be responsible for additional testing costs should they

change suppliers.

**6.2 Sampling and Testing Glass Beads.** Samples may be taken from shipments at any time. At the discretion of the purchaser, the samples may be tested and analysed by an independent authority or otherwise. Results obtained from the analysis showing non-conformity to this specification shall be cause for rejection of all or a portion of the shipment. When the receiver rejects part or all of a shipment, any further testing requested or required by the Supplier shall be at the Supplier's expense.

**7.0 METHOD OF MEASUREMENT**

For purposes of payment, one line-kilometre of centerline painted is the complete centerline configuration for one kilometre of highway regardless of line configuration (single skip, single solid and single skip, double solid or single solid line). Each full kilometre of edge line painted shall be considered as one line-kilometre (maximum two line-kilometres per kilometre of highway). Each full kilometre of lane line painted, either the complete centerline configuration or edge line, shall be considered as one line-kilometre.

**8.0 BASIS OF PAYMENT**

The Contractor will be paid at the contract unit bid price per line-kilometre for Supply and Application of Non-Coning Traffic Paint which price shall be full compensation for all labour, materials, equipment, taxes, and any other expenses including traffic control and vehicles, for each line painted, necessary to complete the work all to the satisfaction of the Engineer.

No compensation will be paid for any traffic line painted that does not meet the requirements of this specification.

**9.0 WARRANTY**



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## Section 7 Calcium Chloride Water Solution

## SECTION 7 - CALCIUM CHLORIDE WATER SOLUTION

## 1.0 DESCRIPTION

This work shall consist of furnishing calcium chloride-water solutions as a surface application.

The term "Anhydrous Calcium Chloride" as used in this specification shall be interpreted to mean 100%  $\text{CaCl}_2$ .

## 2.0 REFERENCES

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Types.** The Calcium Chloride water solutions shall be classified as Type A. The quantity of solution required will be as specified elsewhere in the contract.

Type A: Calcium Chloride shall be a solution having a strength of 35%  $\pm$  1% anhydrous calcium chloride.

**4.1.1 Calcium Chloride.** Unless otherwise provided in the Special Provisions the calcium chloride shall at the Department's option, be furnished in the form of calcium chloride flakes or calcium chloride pellets.

Calcium chloride in pellet and flake form for Type A solutions shall conform to the requirements of Calcium Chloride.

**4.1.2 Water.** The water used shall be clear and free from suspended matter.

**4.1.3 Preparation of Solutions.** To produce solutions having an approximate concentration of 35% anhydrous calcium chloride the following proportions may be used as a guide to make 4000 L of Type A solution:

- 2400 kg 77-80% calcium chloride flakes.
- 3000 kg (3000 L) water.

## 5.0 CONSTRUCTION METHODS

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Sampling and Testing.** The aqueous solution shall be sampled and tested upon delivery by using a standard hydrometer. The hydrometer reading shall be temperature corrected and shall conform to a standard reference chart supplied by the Department.

## 7.0 METHOD OF MEASUREMENT

Calcium chloride flake shall be measured in kilograms. Calcium chloride solution shall be measured in tonnes or as noted below.

As an alternative to weighing for measurement in tonnes, the solution may be measured by means of a metering device conforming to the Government of Canada Weights and Measures Act and Regulations thereto, and the volume of solution converted to an equivalent mass in tonnes of calcium chloride solution. A conversion factor of 1.35 kg/L shall be used in converting the volume of solution to an equivalent mass of solution. When volumetric measurement is used, the Department's representative shall be provided with an invoice for each tank load of solution delivered. The invoice shall indicate the total litre volume of the delivery tanker and certify the actual litre volume delivered in each tank load.

## 8.0 BASIS OF PAYMENT

Payment for calcium chloride flake or solution shall be at the contract unit bid price per kilogram (flake) or per tonne (solution) and shall be full compensation for all labour, equipment and material necessary to complete the work all to the satisfaction of the Engineer.

## 9.0 WARRANTY



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## Section 8 Calcium Chloride

## SECTION 8 - CALCIUM CHLORIDE

## 1.0 DESCRIPTION

This section details the requirements for calcium chloride to be used for dust laying stabilization, ice removal, acceleration of the set of concrete, curing of concrete, and other road conditioning purposes.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the earliest date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 136, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 345, Test Method for Sampling Calcium Chloride for Roads and Structural Applications.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Type.** Calcium chloride shall be supplied as regular flake calcium chloride.

**4.2 Chemical Composition.** The calcium chloride shall conform to the following requirements as to chemical composition:

CaCl<sub>2</sub>, min, percent. 77.0

Total alkali chlorides  
(as NaCl), max.  
percent 3.0

**4.3 Gradation.** The calcium chloride shall conform to the requirements for particle size as detailed in Table 6.8.1.

Table 6.8.1 - Gradation

| Sieve Size | Percent Passing<br>(By Weight) |
|------------|--------------------------------|
| 10 000     | 100                            |
| 5 000      | 80 - 100                       |
| 630        | 0 - 7                          |

**4.4 Packaging and Marking.** The calcium chloride may be delivered in moisture-proof bags containing not more than 45.4 kg each, or in air-tight drums weighing not more than 205 kg each, or it may be delivered in

bulk in tank cars, covered hopper cars, or covered trucks.

## 5.0 CONSTRUCTION METHODS

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Sampling and Testing.** The calcium chloride shall be sampled and tested in accordance with the Methods of Sampling and Testing Calcium Chloride, ASTM D 345. Every facility shall be provided the Purchaser should they elect to have their representative sample the material at the plant. If the Purchaser decides to sample the material after delivery, it shall be understood that 3% variation in content of CaCl<sub>2</sub> from that marked on each container, as required, shall be permissible.

**6.2 Rejection.** The calcium chloride may be rejected if it fails to conform to any of the requirements of these specifications or if it has become caked or sticky in shipment.

**6.3 Sampling.** A mesh lot of calcium chloride shall be sampled for testing purposes as follows:

Not less than three containers shall be selected at random from the lot. Each of the containers shall be sampled by scraping aside the top layer to a depth of approximately 20 mm and taking 500 g samples by means of a sampling thief or other method which shall insure a sample that is representative of a cross-section of the material in the container to a depth of at least 150 mm. Precautions shall be taken during the sampling operation to avoid exposing the sample unduly to atmospheric moisture. The individual samples shall be immediately and thoroughly mixed to form a representative composite sample of material, and stored in a sealed glass container.

## 6.4 Testing

**6.4.1 Sieve Analysis.** Approximately 200 g of calcium chloride weighed to the nearest 0.1 g shall be sieved in accordance with the ASTM C 136, utilizing the 10 000, 5 000 and 630 sieves together with a bottom pan and a cover (sieving shall be completed within a period of approximately 1 minute). The sieve analysis shall be reported on the basis of the grading requirements specified in Subsection 4.3 of these specifications.

**6.4.2 Total Calcium.** Weigh accurately in a bottle a sample of approximately 50 g (Note 1) and dissolve in distilled water. Add sufficient HCl to clear, and then dilute to 500 ml in a volumetric flask and mix

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## Section 8 Calcium Chloride

thoroughly. Pipette a 50 ml aliquot into another 500 ml volume diluted to volume and mix thoroughly. Pipette a 25 ml aliquot and add enough diluted  $\text{NH}_4\text{OH}$  to make slightly alkaline to methyl orange or methyl red. Add 20 ml of cold saturated  $\text{NH}_4\text{Cl}$  solution and dilute to form 100 to 125 ml. Heat to boiling and, while stirring to precipitate the calcium, add 20 ml of cold saturated  $(\text{NH}_4)_2\text{C}_2\text{O}_4$ . Let stand 1 min., and if the precipitate does not show a tendency to settle well, bring back to boiling and continue the stirring. Let settle 20 min. and filter through No. 42, 110 mm. Whatman filters or paper of an equivalent grade. Wash free from oxalate and chloride with hot water. Wash the precipitate back into the original beaker and dilute to about 100 ml. Dissolve the precipitate with 10 to 15 ml of diluted  $\text{H}_2\text{SO}_4$  (1:4) heat to about  $80^\circ\text{C}$ , and titrate to a pink colour with 0.1 N  $\text{KmnO}_4$ . Add the paper, and finish the titration to a faint pink with the standard  $\text{KmnO}_4$ .

- Calculation. Calculate the total calcium as percentage of  $\text{CaCl}_2$ , as follows:

$$\% \text{ of } \text{CaCl}_2 = \frac{\text{ml of } 0.1 \text{ N } \text{KmnO}_4 \times 11.1}{\text{weight of original sample in grams}}$$

The calculated percentage of  $\text{CaCl}_2$  shall be corrected for  $\text{Ca}(\text{OH})_2$  and  $\text{CaCO}_3$ .

#### 6.4.3 Total Alkalinity and Magnesium Compounds.

Weigh accurately a 10.00 g sample (Note 1), place in a 400 ml beaker, and dissolve in 25 ml of water. Add a drop of phenolphthalein indicator, and titrate with 0.1 N  $\text{HCl}$  until the brilliant pink colour fades or becomes a dull, slowly-returning colour when tested by adding another drop or two of indicator. Then add enough of the 0.1 N  $\text{HCl}$  in excess to give a permanent red colour after the addition of a drop of methyl orange indicator. Titrate back to the neutral point with 0.1N  $\text{NaOH}$  and adjust to a faint colour with 0.1 N  $\text{HCl}$ . Use these solutions for the subsequent determination of magnesium compounds.

The net volume of acid used is sometimes calculated as calcium hydroxide for convenience, as follows:

- $\% \text{ of } \text{Ca}(\text{OH})_2 = \text{ml of } 0.1 \text{ N } \text{HCl} \times 0.0037 \times 10$

To the neutral solutions add 9 ml of 1 N  $\text{NaOH}$  which will precipitate  $\text{Mg}(\text{OH})_2$  along with some  $\text{Ca}(\text{OH})_2$ . Filter the precipitate and transfer as much as possible to the filter. Dissolve the precipitate from the paper to the original beaker with about 10 ml of  $\text{HCl}$  (1:1). Add 30 ml of cold saturated  $\text{NH}_4\text{Cl}$ . With a volume of about 150 ml, heat to boiling and add from 50 to 60 ml (or an excess) of cold saturated  $(\text{NH}_4)_2\text{C}_2\text{O}_4$ . Heat just to boiling while stirring, and slowly make alkaline with diluted  $\text{NH}_4\text{OH}$ . Let stand 10 to 15 minutes and filter through a retentive qualitative paper such as Whatman's No. 2 or 3. Save this filtrate. Return the precipitate to the original beaker, dissolve in  $\text{HCl}$ (1:1)

as before, add 15 ml of cold saturated  $\text{NH}_4\text{Cl}$  and 10 ml of the  $(\text{NH}_4)_2\text{C}_2\text{O}_4$ , heat to boiling, and slowly make alkaline with diluted  $\text{NH}_4\text{OH}$ . When the precipitate is well formed and settles readily, filter as before, and combine the two perfectly clear filtrates. Concentrate to about 250 ml. If much magnesium is present, the oxalate may precipitate. Add  $\text{HCl}$  to dissolve it. At a temperature of approximately  $70^\circ\text{C}$ , slowly add 10 ml of  $(\text{NH}_4)_2\text{HPO}_4$  (15%). Add  $\text{NH}_4\text{OH}$  (sp. gr. 0.90) slowly until the precipitate is formed, then add excess. Let stand over night, stirring vigorously several times and also just before filtering. Filter through a Gooch crucible or a No. 42 Whatman paper of equivalent quality, and wash with cold  $\text{NH}_4\text{OH}$  (1:10). Ignite to constant weight and weigh as  $\text{Mg}_2\text{P}_2\text{O}_7$ . If the alkalinity is appreciable and the total magnesium low, this should be calculated as  $\text{Mg}(\text{OH})_2$ . Any balance of magnesium over total alkalinity would be  $\text{MgCl}_2$ .

- Calculations. Calculate the percentage of  $\text{Mg}(\text{OH})_2$  as follows:

$$\% \text{ of } \text{Mg}(\text{OH})_2 = \text{grams of } \text{Mg}_2\text{P}_2\text{O}_7 \times 0.524 \times 10$$

$$\% \text{ of } \text{Mg}(\text{OH})_2 \times 34.3 = \text{ml of } 0.1 \text{ N } \text{HCl due to } \text{Mg}(\text{OH})_2$$

If the alkalinity titration with phenolphthalein was stopped and the millilitres recorded when the brilliant pink faded, the millilitres represent actual  $\text{Ca}(\text{OH})_2$  present, as follows:

$$\% \text{ of } \text{Ca}(\text{OH})_2 = \text{ml of } 0.1 \text{ N } \text{HCl} \times 0.0037 \times 10$$

The difference (millilitres for methyl orange end point minus millilitres for phenolphthalein end point) minus millilitres due to  $\text{Mg}(\text{OH})_2$  equals the millilitres due to  $\text{CaCO}_3$  as follows:

$$\% \text{ of } \text{CaCO}_3 = \text{ml of } 0.1 \text{ N } \text{HCl due to } \text{CaCO}_3 \times 0.0050 \times 10$$

$$\% \text{ as } \text{CaCl}_2 = (\text{ml for } \text{Ca}(\text{OH})_2 + \text{ml for } \text{CaCO}_3) \times 0.00555 \times 10$$

Deduct this latter percentage from total calcium as net  $\text{CaCl}_2$ .

#### 6.4.4 Total Alkali Chlorides as Sodium Chloride.

The chlorides  $\text{KCl}$  and  $\text{NaCl}$  shall be determined together. Where it is desired to distinguish between them, the potassium may be determined by any standard method and the two reported separately. The perchlorate method may be used for this determination. For routine work the  $\text{KCl}$  and  $\text{NaCl}$  shall be reported as  $\text{NaCl}$ . The method used shall be as follows:

Dissolve an 8.000 g sample (Note 2) in 50 ml of hot water, add 1 g of reagent grade  $\text{Ca}(\text{OH})_2$ , mix well, and boil gently for 1 min. Dilute to exactly 100 ml in a volumetric flask. Filter through a dry paper, discarding the first 10 ml, pipette a 25.00 ml aliquot, add 20 ml of



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water; heat to boiling and add 50 ml of hot  $(\text{NH}_4)_2\text{C}_2\text{O}_4$  (5%) or  $(\text{NH}_4)_2\text{CO}_3$  (4%)-preferably the latter. Dilute to 100 ml and mix well. Let stand until the temperature is about that of the room and adjust the volume. Finally, filter through a dry retentative filter paper, discarding the first 10 ml and refiltering if cloudy. Pipette a 25.00 ml aliquot in a 250 ml beaker and add 1 ml of  $\text{HCl}$ (sp.gr.1.19). Evaporate to dryness on a steam bath. Thoroughly ignite in a muffle or heat-treating furnace (Note 3) at 300 to 350°C. In about 30 min., organic and ammonium salts should have been driven off. Cool, dissolve in 10 ml of water, add 3 drops of  $\text{Na}_2\text{CrO}_4$  or  $\text{K}_2\text{CrO}_4$  (5%) solution as indicator, and titrate with 0.02 N  $\text{AgNO}_3$  (Note 4) to a pink end point. If the ignition was correctly done, there will be but little brown or yellow colouration due to charred organic residue with seeing the end point. Run a blank on the reagents used. If this is less than 0.5 ml neglect it, if over 0.5 ml subtract from the titration after deducting 0.5 ml (1.00 ml of 0.02 N  $\text{AgNO}_3$  is equivalent to 0.00117 g.  $\text{NaCl}$ ). In the method as given, 0.500g of sample is finally titrated.

- Calculation. Calculate the total alkali chlorides as sodium chloride as follows:

$$\% \text{ of NaCl} = \frac{\text{ml of 0.02 N AgNO}_3 \times 0.00117 \times 1.05 \times 100}{0.500}$$

or

$$\% \text{ of NaCl} = \text{ml of 0.02 N AgNO}_3 \times 0.246$$

**6.4.5 Rapid Technical Method.** For ordinary purposes, where the quantity of material purchased does not warrant the employment of the foregoing method of analysis, calcium chloride will be deemed as the satisfactory if the total chlorides present, determined by titration with 0.1 N  $\text{AgNO}_3$  and calculated to  $\text{CaCl}_2$ , is in excess of 78% and if not more than a slight precipitate of  $\text{Mg}(\text{OH})_2$  appears when a 10% filtered solution of the material is made alkaline with  $\text{NH}_4\text{OH}$ .

No material shall be rejected under this technical method of analysis, and in case the calcium chloride tested by this rapid procedure does not conform to the specifications, it shall analyzed by the methods described in Subsection 6.4.2 to 6.4.4 of this specification.

- Explanatory Notes

Note 1: If a large amount of  $\text{MgCl}_2$  (2 or 3%) is present, the calculation of  $\text{CaCO}_3$  will be inaccurate.

Note 2: Instead of weighing separate samples as indicated in Subsections 6.4.2 to 6.4.4 a 50 g sample

may be dissolved and diluted to 500 ml in a volumetric flask with distilled water. For the procedure in Subsection 6.4.2, pipette a 50 ml aliquot into another 500 ml volumetric flask and dilute to volume. From this second flask, containing 5 g of original sample, pipette a 25 ml aliquot as indicated in Subsection 6.4.2 and continue the procedure for total calcium as outlined. For the procedure in Subsection 6.4.3, measure for alkalinity and magnesium compounds. For the procedure in Subsection 6.4.4, measure 80 ml of solution from a burette, which will represent 8 g of sample for the alkali chlorides.

This handling will render accurate distribution of the insoluble  $\text{Mg}(\text{OH})_2$  and  $\text{CaCO}_3$  present more difficult than using direct weighted samples. However, if each volumetric flask is well mixed before each portion is removed, fairly accurate results can be expected. Instead of weighing accurately a 10.00 gram sample, a sample of approximately 10 grams may be used if desired, in which case the percentage of  $\text{Ca}(\text{OH})_2$  may be calculated as follows:

$$\% \text{ of Ca}(\text{OH})_2 = \frac{\text{ml of 0.1 N HCl} \times 0.0037 \times 100}{\text{weight of sample in grams}}$$

Note 3: In case a muffle or furnace with close heat control is not available, a moderate bunsen flame played over the beaker may be used to volatilize the ammonium and organic compounds. In this case it would be advisable to control the determination by means of a known mixture having  $\text{NaCl}$  present in the same magnitude.

Note 4: The 0.02 N  $\text{AgNO}_3$  may be conveniently made by diluting 50.00 ml of exactly 0.1 N solution to a 250 ml volume. There is empirical correction to be made on the factor which amounts to the 0.02 N value being multiplied by about 1.05. This can be determined exactly by running on known mixtures having the same magnitude and composition as the calcium chloride to be analyzed.

## 7.0 METHOD OF MEASUREMENT

Calcium chloride flake shall be measured in kilograms.

## 8.0 BASIS OF PAYMENT

Payment of calcium chloride flake shall be full compensation for all labour, equipment and material required to do the work.

## 9.0 WARRANTY





## Division 6 Miscellaneous

## Section 9 Sodium Chloride

## SECTION 9 - SODIUM CHLORIDE

## 1.0 DESCRIPTION

This section details the requirements for the supply of sodium chloride intended for deicing roadways.

## 2.0 REFERENCES

## 3.0 SUBMISSIONS AND REQUIREMENTS

The sodium chloride shall be delivered in bags or bulk lots. The name of the Producer and the net weight shall be legibly marked on each bag or, in the case of bulk lots, on the shipping or delivery report.

## 4.0 MATERIALS

Sodium chloride obtained from natural deposits (rock salt) or produced by man (evaporated, solar, or other) shall meet the following requirements.

## 4.1 General. The material shall consist of:

- Sodium Chloride (NaCl)... 94.0% (tolerance, -0.5%)
- Moisture Content..... 1.5% maximum

## 4.2 Gradation. Sodium chloride shall conform to the requirements as detailed in Table 6.9.1.

Table 6.9.1 Gradation of Sodium Chloride

| Sieve Size | Percent Passing<br>point of purchase | Tolerance<br>delivery point |
|------------|--------------------------------------|-----------------------------|
| 14 000     | 100                                  | 0                           |
| 10 000     | 95 - 100                             | 0                           |
| 5 000      | 20 - 90                              | ± 5.0                       |
| 2 500      | 10 - 60                              | ± 5.0                       |
| 630        | 0 - 10                               | ± 5.0                       |

4.3 Condition. Sodium chloride material shall always be in a free-flowing state until used. All sodium chloride material shall be uniformly treated with an anti-caking conditioner (YPS or equivalent). The conditioner shall be uniformly applied at a minimum rate of 50 ppm by the Supplier.

## 5.0 CONSTRUCTION METHODS

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

6.1 Inspection, Sampling and Testing. Sodium Chloride under this specification shall be subject to inspection and testing. The Department or its representative shall be provided free entry and access to the Suppliers production facilities for sampling purposes.

Samples of the sodium chloride may be taken at the point of delivery at the discretion of Department or its representative.

Sodium chloride samples from the point of purchase shall be taken from the suppliers production line.

All sodium chloride for analysis shall be sampled in increments of three, selected at random. Each sample shall be obtained by means of a sampling thief or other methods which will assure a representative cross section of the material.

6.2 Non-Conformance. Suppliers of sodium chloride shall provide Quality Response Reports (QRR) on Department request for materials which fail to conform to the requirements of this specification.

The Supplier's reports shall include the following:

- Name/location of person spoken with
- Description of performance problem
- Quantity of material involved
- Laboratory analysis
- Remedial action, if any.

Reports shall be forwarded for review on a monthly basis to the Department contract representative.

## 7.0 METHOD OF MEASUREMENT

Measurement of the Sodium Chloride shall be made on the basis of tonnes.

## 8.0 BASIS OF PAYMENT

Payment for delivery of sodium chloride will be made at the contract unit price bid per tonne which price shall be full compensation for all equipment, plant, labour, associated transportation costs and incidentals necessary to deliver the sodium chloride to the specified location.

## 9.0 WARRANTY



## Division 6 Miscellaneous

## Section 10 Winter Sand

## SECTION 10 - WINTER SAND

## 1.0 DESCRIPTION

This section details the requirements for the supply and delivery of winter sand used for snow and ice control as directed by the Engineer.

## 2.0 REFERENCES

All reference standards shall be the current issue or latest revision at the earliest date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM C 117, Test Method for Material Finer Than 75µm Sieve in Mineral Aggregates by Washing
- ASTM C 136, Method for Sieve Analysis Fine and Coarse Aggregates
- ASTM D 2216, Method for Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate Mixtures

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 General.** Winter sand shall consist of natural or manufactured aggregate. Winter sand shall be composed of clean, hard uncoated particles and shall be free of organic matter, clay lumps and other deleterious material.

**4.2 Gradation.** The gradation of the winter sand shall conform to the requirements as detailed in Table 6.10.1 when tested by washed sieve analysis according to ASTM C 117 and ASTM C 136.

Table 6.10.1 Gradation of Winter Sand

| Sieve Designation | Cumulative Percent Passing |
|-------------------|----------------------------|
| 10 000            | 100                        |
| 2 500             | 65 - 95                    |
| 1 250             | 40-90                      |
| 630               | 20 - 70                    |
| 315               | 5 - 35                     |
| 160               | 0 - 15                     |
| 80                | 0 - 6                      |

**4.3 Moisture Content.** When delivered, the maximum

allowable moisture content for winter sand shall not exceed 7%, when tested in accordance with ASTM D 2216.

## 5.0 CONSTRUCTION METHODS

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

**6.1 Sampling and Inspection.** Materials shall be sampled and inspected by the Department prior to stockpiling at the designated locations. This acceptance shall not preclude further stockpile sampling, which may or may not lead to rejection of the material.

The frequency of testing shall be determined by the Engineer. The number of tests shall be sufficient in number to ensure the provision of an acceptable product.

## 7.0 METHOD OF MEASUREMENT

The measurement for payment shall only be for those materials accepted for use under this specification.

**7.1 Volume Measurement.** Where the contract unit price states that winter sand is to be stockpiled and the unit of measurement as stated in the contract is in cubic metres, then such stockpiles shall be cross-sectioned and the volume computed in cubic metres rounded to the nearest whole number.

The quantity to be measured shall be the number of cubic metres of stockpiled winter sand as shown on the cross sections between the graded base of the stockpile as cross-sectioned before stockpiling and the cross sections made over the completed stockpile. The volume of this stockpile being computed by the average end area method or as wedges or pyramids, as the case may be when terminating at grade points.

**7.2 Weight Measurement.** Where the contract unit price states that winter sand is to be stockpiled and the unit of measurement as stated in the contract is tonnes, then the winter sand shall be weighed on scales.

The Contractor shall where required, at their own expense, provide, install and maintain such approved scales and all suitable facilities as may be required for the Department to determine accurately the weight of winter sand, loaded in each truck in tonnes, rounded to one decimal place.

## 8.0 BASIS OF PAYMENT

Payment for winter sand will be at the contract unit price

**Division 6 Miscellaneous**

**Section 10 Winter Sand**

per tonne or alternatively at the contract unit price per cubic metre for winter sand accepted and delivered and shall be full compensation for the furnishing of all materials, equipment, labour, and any incidentals necessary to complete the work to the satisfaction of

the Engineer.

**9.0 WARRANTY**



## Division 7 Environmental Protection

## Section 1 Sediment Barriers

## SECTION 1 - SEDIMENT BARRIERS

## 1.0 DESCRIPTION

The Contractor shall, where directed, supply, install, replace and remove sediment barriers. Sediment barriers are to be used as temporary perimeter control to intercept sediment laden runoff before it enters a watercourse or as it leaves the construction site.

For the purpose of this specification sediment barriers shall consist of four distinct types:

- Straw Barriers
- Silt Fence Barriers
- Berm Barriers
- Sandbag Barriers

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- CGSB 148.1 Method 10.2., Specification for filtration opening size of Geotextiles.
- Drawing HS701.DWG.
- Drawing HS702.DWG.
- Drawing HS703.DWG.
- Drawing HS704.DWG.
- Division 7 Section 4, Maintenance and Sediment Control.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Straw Barriers.** Straw bales shall be dry, firm, tightly tied in a least two places, show no evidence of straw or tie decay, and be free of sediment. They shall be standard agriculture dimensions, approximately 600 mm x 600 mm x 1200 mm.

**4.1.1 Stakes.** Stakes shall be of sufficient strength to satisfy control measure performance and maintenance requirements. Stakes shall be 1.2 m in length.

**4.2 Silt Fence Barriers.** Silt fence barriers shall be constructed of silt fence geotextile supported on stakes.

Geotextile used for silt fence shall be woven Class 1 geotextile, having a minimum width of 900 mm. The maximum filtration opening size (FOS) shall be 840  $\mu$ m.

**4.2.1 Stakes.** Stakes shall be of sufficient strength to satisfy control measure performance and maintenance requirements. Stakes shall be 1.5 m in length.

**4.3 Berm Barriers.** Berm barriers shall be constructed of earth material placed in windrows.

**4.4 Sandbag Barriers.** Sandbag barriers shall be constructed of three layers of sandbags. The bottom layer shall consist of 3 rows of bags, the middle layer shall consist of 2 rows of bags and the top layer shall consist of 1 row of bags.

The recommended dimension of a filled sandbag shall be approximately 150 mm x 150 mm x 450 mm.

## 5.0 CONSTRUCTION METHODS

**5.1 Straw Barriers.** Where straw bale barriers are to be installed on earth surfaces, the bales shall be placed in a trench measuring 750 mm wide by 150 mm deep at the location specified for the barrier. The bales shall then be staked and the remaining trench space backfilled and compacted to existing grade.

Where straw bale barriers are to be installed on sod, erosion control blanket or existing turf, they shall be placed so that there are no gaps between the bales and the underlying cover.

Straw bale ties shall not be placed in contact with the ground.

The ends of adjacent bales shall be placed tightly against one another to prevent gaps.

Each bale shall be firmly secured in place by two stakes spaced 150 mm from the end of each bale. Stakes shall be driven flush with the top of bale.

Straw barriers shall be maintained such that bales remain firm, intact, and without decay.

At each end of the barrier a 2 to 3 m section, angled upstream, shall be included to direct run-off to the main section of the barrier.

Bales shall be replaced at intervals not exceeding 30 days.

**5.2 Silt Fence Barriers.** Stakes shall be spaced a maximum of 3.0 m apart and shall be driven vertically into the ground to a depth of 500 mm.

A trench measuring 100 mm wide by 100 mm deep shall be excavated to anchor the geotextile along its entire length.

The geotextile shall be attached to the upstream side of

**Division 7 Environmental Protection****Section 1 Sediment Barriers**

the stakes, and shall extend into the trench a minimum of 200 mm. It shall be placed without gaps or breaks along its entire length. Where the geotextile is joined to provide a continuous run, the ends shall be securely fastened and overlapped a minimum of 500 mm.

The trench shall be backfilled and compacted to existing grade to hold the base of the geotextile firmly in place. The completed silt fence shall have a minimum height of 600 mm above the ground surface.

At the end of the barrier a 2 to 3 m section, angled upstream, shall be included to direct run-off to the main section of the barrier.

Silt fence barriers shall be maintained vertical, without tears and without sagging.

**5.3 Berm Barriers.** Berm barriers shall be constructed to a minimum height of 600 mm above the ground on which they are placed.

The upstream slope of the barrier shall be 1.5:1 maximum and the downstream slope shall be 4:1 maximum.

At the end of the barrier a 2 to 3 m section, angled upstream, shall be included to direct run-off to the main section of the barrier.

Berm barriers shall be maintained at a specified height and slope without sloughing and slumping.

**5.4 Sandbag Barriers.** The bags within each row shall be placed with the sides of the bags butted tightly against one another without gaps. The ends of sandbags in adjacent rows shall be butted tightly against each other without gaps.

The sandbags in each row shall be uniformly staggered to one another. The sandbags in each layer shall uniformly overlap the layer below.

Where sandbag barriers are to be installed on earth surfaces, a trench 150 mm deep, and sufficiently wide to accommodate three sandbags laid end to end, shall be excavated at the location specified for the barrier. The sandbags shall then be placed and the remaining trench space backfilled and tamped to existing grade.

Where sandbag barriers are to be installed on sod, erosion control blanket, existing turf, or bedrock, they shall be placed so that there are no gaps between the

sandbags and the underlying surface.

At each end of the barrier a 2 to 3 m section, angled upstream, shall be included to direct run-off to the main section of the barrier.

Sandbag barriers shall be maintained with bags uniform and firmly seated.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for Sediment Barriers shall be by the metre of barrier installed or replaced, from end to end, following the contours of the ground.

**8.0 BASIS OF PAYMENT**

- Straw Barriers
- Silt Fence Barriers
- Berm Barriers
- Sandbag Barriers

Payment at the contract unit price for the above tender item(s) shall be full compensation for all labour, equipment and material required to do the work including the supply and installation of erosion control blankets if barriers are removed.

Payment will be made as per Division 7 Section 1 for sediment barriers replaced if the original barriers had been properly installed or constructed and approved by the Engineer and failure was not attributable to the Contractor.

Payment will be made as per Division 7 Section 4 for sediment barriers needing repair if the original barriers had been properly installed or constructed and approved by the Engineer and failure was not attributable to the Contractor.

It will be at the discretion of the Engineer whether payment as per Division 7 Section 1 or Division 7 Section 4.

Maintenance of sediment barriers and removal and management of sediment that is accumulated by sediment barriers will be paid as per Division 7 Section 4.

**9.0 WARRANTY**

## Division 7 Environmental Protection

## Section 2 Flow Checks

## SECTION 2 - FLOW CHECKS

## 1.0 DESCRIPTION

The Contractor shall, where directed, supply, install, replace and remove flow checks. Flow checks shall be constructed across roadside drainage ditches, throughout cut sections and adjacent to the inlets and outlets of culverts to reduce the channel velocity, promote the deposition of suspended sediment and provide a trap for bed-load material.

For the purpose of this specification flow checks shall comprise three distinct types:

- Straw Bale Flow Checks
- Sandbag Flow Checks
- Rock Flow Checks

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 3 Section 4, Clear Stone.
- Division 7 Section 1, Sediment Barriers.
- Division 7 Section 4, Maintenance and Sediment Control.
- Drawing HS705.DWG.
- Drawing HS706.DWG.
- Drawing HS707.DWG.
- NSDOE, Erosion Control and Sedimentation Control Handbook for Construction Sites.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

 **4.1 Clear Stone.** C2 and C5 Clear Stone as per Division 3 Section 4 of these specifications shall be used as shown on the plans or as directed by the Engineer.

**4.2 Straw Bale Flow Checks.** Straw bale flow checks shall be constructed of a double row of bales.

**4.3 Sandbag Flow Checks.** Sandbag flow checks shall be constructed of three layers of sandbags.

**4.4 Rock Flow Checks.** Rock flow checks shall be constructed of clear stone.

## 5.0 CONSTRUCTION METHODS

**5.1 Straw Bale Flow Checks.** The requirements for straw barriers, Division 7 Section 1, shall apply with some modifications. Where straw bale flow checks are

to be installed on earth surfaces the trench shall be 1500 mm wide. The two rows of bales shall be butted tightly beside one another without gaps. The bales in the two rows shall be uniformly staggered to one another, so that the ends of the upstream row of bales are adjacent to the centers of the downstream row of bales. The ends of the flow check, at ground level, shall be higher than the top of the lowest point of the flow check. The upstream row of bales shall be one bale longer than the downstream row.

**5.2 Sandbag Flow Checks.** The requirements for sandbag barriers, Division 7 Section 1, shall apply with some modifications. The ends of the flow check, at ground level, shall be higher than the top of the lowest point of the flow check.

## 5.3 Rock Flow Checks.

**5.3.1 During Construction.** During construction rock flow checks may have to be placed across a ditch or channel. Both 150 mm minus Clear Stone and 20 mm minus Clear Stone shall be piled across the ditch or channel to a height 450 mm above the lowest point of the ditch or channel.

**5.3.2 After Final Grading.** After final grading rock flow checks may have to be placed across a ditch or channel. Both 150 mm minus Clear Stone and 20 mm minus Clear Stone shall be piled across the ditch or channel to a height 350 mm above the lowest point of the ditch or channel.

On the downstream side of the flow check an apron shall be constructed to prevent scour. The apron shall consist of an approved erosion control blanket placed on the existing ground or 150 mm minus Clear Stone placed in a 250 mm excavated trough. In both cases the erosion control blanket or Clear Stone shall extend across the entire ditch or channel and up the side slopes to an elevation equaling the height of the flow check. The length of apron shall be between 1.5 and 2.0 m.

On the upstream side of the flow check a trough, 4000 mm (minimum) in length and equal to the width of the existing ditch or channel shall be excavated to a depth of 150 mm.

**5.3.3 Overflow Weir.** A level overflow weir 150 mm deep shall be formed in the top of the flow check so that it extends from the upstream to the downstream side and its crest is centered over the lowest portion of the ditch or channel. The overflow weir crest should extend 300 mm on either side of centerline.

**Division 7 Environmental Protection****Section 2 Flow Checks**

**5.3.4 Installation and Maintenance.** Rock flow checks shall be installed and maintained in place, without gaps, and without undermining, to prevent sediment passage through or under the flow check.

**5.4 Buffer Zones.** Flow checks shall be constructed within each culvert buffer zone to the prescribed installation techniques contained in the "Erosion and Sedimentation Control Handbook for Construction Sites" Section 2.7, which states "make sure the top of the check dam (flow check) is as high as the base of the one upstream."

**5.5 Ditching.** Flow checks shall be constructed along any new ditching of the highway including the median at spacings to be determined by dividing 200 m by the ditch grade in percent. Flow checks are to be installed during construction and after ditches are brought to final grade.

**5.6 Catch Basins.** Flow checks shall be constructed around new catch basins located in the highway median.

**5.7 Removal.** After vegetation has established and at the direction of the Engineer, flow checks may have to be removed. If necessary, the unvegetated areas remaining, after flow checks removed, shall be covered with an approved erosion control blanket.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for Flow Checks shall be by the metre of flow checks installed or replaced, measured

horizontally across the top of the flow check as noted on specification drawings HS705.Dwg, HS706. Dwg, HS707.Dwg.

**8.0 BASIS OF PAYMENT**

- Straw Bale Flow Checks
- Sandbag Flow Checks
- Rock Flow Checks

Payment at the contract unit price for the above tender item(s) shall be full compensation for all labour, equipment and material to do the work.

Payment will be made as per Division 7 Section 2 for flow checks replaced if the original flow checks had been properly installed or constructed and approved by the Engineer and failure was not attributable to the Contractor.

Payment will be made as per Division 7 Section 4 for flow checks needing repair if the original flow checks had been properly installed or constructed and approved by the Engineer and failure was not attributable to the Contractor.

It will be at the discretion of the Engineer whether payment as per Division 7 Section 2 or Division 7 Section 4.

Maintenance and removal and management of sediment that is accumulated by flow checks will be paid for under Division 7 Section 4.

**9.0 WARRANTY**



## Division 7 Environmental Protection

## Section 3 Settlement Ponds

**SECTION 3 - SETTLEMENT PONDS****1.0 DESCRIPTION**

The Contractor shall, where directed, construct and remove settlement ponds. Settlement ponds are to be used to intercept and retain sediment laden runoff so that sediment may settle out.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 3, Roadway and Drainage Excavation
- Division 2 Section 5, Borrow.
- Division 2 Section 8, Compaction.
- Division 3 Section 4, Clear Stone.
- Division 7 Section 4, Maintenance and Sediment Control.
- Drawing HS708, Settlement Ponds.

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

C2 Clear Stone and C5 Clear Stone as per Division 3 Section 4 of these specifications shall be used as shown on the plans or as directed by the Engineer.

**5.0 CONSTRUCTION METHODS**

Settlement ponds shall be built as a single control measure, consisting of an excavated and/or constructed basin, a spillway and a clear stone filter.

The excavated basin shall have a minimum depth of 1.2 m below the existing ground surface. The bottom of the excavated basin shall be horizontal and the sides of the basin shall be no steeper than 1.5:1.

If the sides of the basin are constructed the embankment material shall be impervious borrow or common material.

The inside walls of the sediment pond should be lined with 150 mm minus Clear Stone.

The top of spillway shall be constructed 300 mm below the top of the settlement pond wall.

The outside face of the spillway shall be offset 300 mm inward from the outside face of the settlement pond wall.

The inside faces of both the spillway and the settlement

pond shall be flush.

At the discretion of the Engineer a temporary fence shall be erected around the settlement pond to restrict public access.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT****8.0 BASIS OF PAYMENT**

Payment for settlement ponds will be at the individual contract unit prices for Roadway and Drainage Excavation Common, Borrow, Compaction and Clear Stone.

Payment for Roadway and Drainage Excavation Common will be made as per Division 2 Section 3 for all material excavated to construct the settlement pond which shall be full compensation for all labour, equipment, and materials required to do the work, after the construction of the settlement pond has been approved by the Engineer.

Payment for Borrow will be made as per Division 2 Section 5 for all Borrow required to construct the settlement pond which shall be full compensation for all labour, equipment, and materials required to do the work, after the construction of the settlement pond has been approved by the Engineer.

Payment for Compaction will be made as per Division 2 Section 8 for all Compaction required to construct the settlement pond which shall be full compensation for all labour, equipment, and materials required to do the work, after the construction of the settlement pond has been approved by the Engineer.

Payment for Clear Stone will be made as per Division 3 Section 4 for all Clear Stone required to construct the settlement pond which shall be full compensation for all labour, equipment, and materials required to do the work, after the construction of the settlement pond has been approved by the Engineer.

Payment will be made as per Division 2 Section 3, Division 2 Section 5, Division 2 Section 8 and Division 3 Section 4 for settlement ponds replaced if the original settlement pond has been properly constructed and approved by the Engineer and failure was not attributed to the Contractor.

Payment will be made as per Division 7 Section 4 for



## **Division 7 Environmental Protection**

repair of settlement ponds if the original settlement pond had been properly constructed and approved by the Engineer and failure was not attributed to the Contractor.

It will be at the discretion of the Engineer whether payment will be as per Division 2 Section 3, Division 2 Section 5, Division 2 Section 8 and Division 3 Section 4 or Division 7 Section 4.

## **Section 3 Settlement Ponds**

Maintenance of settlement ponds and the removal and management of sediment that accumulates in settlement ponds shall be paid for as per Division 7 Section 4.

### **9.0 WARRANTY**

## Division 7 Environmental Protection

## Section 4 Maintenance and Sediment Control

**SECTION 4 - MAINTENANCE AND SEDIMENT CONTROL****1.0 DESCRIPTION**

This item of work shall consist of the maintenance of sediment control devices and the removal and management of sediment that is accumulated by sediment barriers, flow checks and settlement ponds.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 7 Section 1, Sediment Barriers
- Division 7 Section 2, Flow Checks
- Division 7 Section 3, Settlement Ponds

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS****5.0 CONSTRUCTION METHODS**

To ensure that erosion and sediment control measures are in effective working order, their condition shall be monitored prior to any forecast storm event, during a storm and following a storm event.

Sediment that is accumulated by sediment barriers, flow checks and settlement ponds shall be removed in a manner that prevents the escape of sediment to the

downstream side of the control device and avoids damage to the control device. Sediment shall be removed to the level of the existing grade at the time of the control device installation.

Accumulated sediment shall be removed once it reaches a depth of one-half the effective height of the control measure or a depth of 300 mm immediately upstream of the control device.

For all control devices, accumulated sediment shall be removed as necessary to perform maintenance repairs.

Accumulated sediment shall be removed immediately prior to the removal of the control devices.

The sediment removed shall be managed as excess common excavation.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for sediment control shall be by the extra work for time spent removing sediment and water.

**8.0 BASIS OF PAYMENT**

Payment by extra work will be full compensation for all labour, equipment, and materials and all pumping required to do the work.

**9.0 WARRANTY**



## Division 7 Environmental Protection

## Section 5 Hydroseeding

## SECTION 5 - HYDROSEEDING

## 1.0 DESCRIPTION

This item of work shall consist of the supply and application of a mixture of seed, fertilizer, mulch, binder and water on foreslopes, median, backslopes, ditches and other prepared areas designated by the Engineer, to produce a uniform cover of grasses.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 7 Section 6, Mulching.
- Division 7 Section 7, Erosion Control Blankets.
- Division 7 Section 8, Topsoil.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

All materials shall be supplied by the Contractor.

The seed mix shall consist of:

- 40% Creeping Red Fescue
- 15% Timothy
- 15% Tall Fescue
- 10% Kentucky Blue Grass
- 10% Alsike Clover
- 5% Red Top
- 5% Perennial Rye

At the discretion of the Engineer, oats may be included in the seed mix.

Each species shall meet or exceed the Canadian Grade Standards for Common No. 1 seed.

Fertilizer shall be 15-25-15 for seeding done May 1st to September 1st and 10-20-20 thereafter. Fertilizer shall conform to the Canada Fertilizer Act and Regulations.

Mulch shall be shredded newsprint (cellulose) or wood fiber colored green with environmentally acceptable dye. Mulch shall contain no toxic or growth-inhibiting chemicals or compounds.

Binder (tackifier) may be supplied in liquid or powder form and shall be applied at the Manufacturer's recommended application rate.

Water shall be free of any impurities which would inhibit germination of grasses.

Bags of seed and fertilizer shall be labeled, identifying

mass (kg), mix components and percentages, date of bagging and supplier's name. Alternatives to the specified seed and fertilizer mixes will not be accepted without prior approval of the Engineer. The Engineer may sample the seed and fertilizers for analysis. 

Seed and fertilizer shall be kept dry and protected from sunlight and other detrimental conditions. Seed and fertilizer that have been subjected to moisture will not be acceptable for use. 

## 5.0 CONSTRUCTION METHODS

Hydroseeding shall be carried out as soon as possible after the completion of the surface preparation. Final dressing of the slopes shall be done as areas are completed to enable hydroseeding to be done in stages as work progresses, in accordance with the Work Progression Schedule of the contract. 

Hydroseeding will not be permitted on hardened or crusted soil. Final dressing of slopes shall include removal of deleterious materials such as sticks, roots or large rocks; loosening of the top 50 mm of soil; and scarification to minimize runoff velocities. 

Scarifications shall be parallel to the contour of the slope with a minimum indentation (high to low) of 25 mm and at a maximum spacing of 150 mm. Scarifying can be made by means of dozer treads or any other mechanical means such that scarifications meet the above noted specifications. If topsoil is to be utilized it shall be placed in accordance with Division 7 Section 8, Topsoil. 

Hydroseeding shall not be performed under windy conditions or during periods of rainfall, on areas covered by standing water, on frozen surfaces or under other adverse conditions, as determined by the Engineer.

The mulch, seed, fertilizer and binder shall be thoroughly mixed with water in a hydroseeding tank capable of continually agitating the mixture during the hydroseeding operation to ensure that a homogeneous slurry is produced.

Application rates shall be as detailed in Table 7.5.1.

## Division 7 Environmental Protection

## Section 5 Hydroseeding

Table 7.5.1 - Application Rates

| Hydroseeding 'A'                                                      | Hydroseeding 'B'                                                      |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------|
| Seed - 100 kg/ha                                                      | Seed - 100 kg/ha                                                      |
| Fertilizer - 625 kg/ha                                                | Fertilizer - 625 kg/ha                                                |
| Mulch (paper or wood fiber) - 1350 kg/ha                              | Mulch (paper or wood fiber) - 350 kg/ha                               |
| Binder <sup>(1)</sup> (tackifier) - per Manufacturer's specifications | Binder <sup>(1)</sup> (tackifier) - per Manufacturer's specifications |

<sup>(1)</sup> Binder shall be used for all hydroseeding work. Application rates may vary  $\pm 10\%$  depending on ground conditions, at the discretion of the Engineer.

The Contractor shall proportion the ingredients in the hydroseeding tank according to the size of the tank and the area anticipated to be covered with each tankful of mix, so that the materials are applied at the prescribed rates. The Contractor shall adjust the quantities of ingredients per tankful as required if the actual coverage ( $m^2/tank$ ) is different from that anticipated.

The mixture shall be applied uniformly onto prepared surfaces from a hydroseeder which shall be capable of spraying the extremities of slopes or other areas of exposed ground, whether through the towergun nozzle or extension hose.

Hydroseeding 'A' and Hydroseeding 'B' carried out between May 1<sup>st</sup> and September 1<sup>st</sup> shall produce a satisfactory growth of grasses and clover at least 95 percent of the area seeded. Areas of poor growth that exceed 5 percent of the total area seeded shall be reseeded at the Contractor's expense. The success of the seeding will be judged by the Engineer at the end of the growing season (September 1<sup>st</sup>).

Hydroseeding carried out after September 1<sup>st</sup> will be measured for full payment if the ground preparation,

hydroseeding and mulching (with tackifier) have been carried out in accordance with this specification.

Hydroseeding 'B' shall be used when hydroseeding is to be covered with mulch or erosion control blanket. In these cases hydroseeding shall be covered with mulch or erosion control blanket within 48 hours.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT.

Measurement for hydroseeding shall be the area in square metres acceptably hydroseeded using the aforementioned seed mix, fertilizer, lime, mulch and binder, measured along the slope of the ground.

## 8.0 BASIS OF PAYMENT

- Hydroseeding 'A'
- Hydroseeding 'B'

Payment for hydroseeding at the contract unit price shall be full compensation for all labour, equipment and material necessary to perform the work.

Preparation of slopes or other areas for hydroseeding and removal of deleterious materials will not be measured for payment, but shall be considered as incidental to the bid items under which the excavation or embankment construction of such areas was carried out.

Payment for mulching over hydroseeded areas will be measured for payment as per Division 7 Section 6.

Placing Erosion Control Blanket over hydroseeded areas will be as per Division 7 Section 7.

If topsoil is used, payment for topsoil will be made as per Division 7 Section 8.

## 9.0 WARRANTY



## Division 7 Environmental Protection

## Section 6 Mulching

## SECTION 6 - MULCHING

## 1.0 DESCRIPTION

This item of work shall consist of the supply and application of mulch on slopes and other exposed ground as a temporary measure to prevent erosion of the exposed ground and siltation of watercourses.

## 2.0 REFERENCES

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

Requests to use hydraulic mulches other than those listed in Subsection 4.0 shall be submitted in writing to the Engineer. Approval by the Engineer is required before optional mulches can be used.

## 4.0 MATERIALS

Mulch shall be supplied by the Contractor. It shall be hay or straw, in an unprocessed form such as in bales or rolls, free of noxious weeds and other undesirable material and not so wet, decayed or compacted so as to inhibit even and uniform spreading; or in processed form, being shredded straw or wood fibre, and packaged in plastic bags. Approved processed hydraulic mulches are as follows:

- Verdoyl
- Fibrmulch
- Conwed
- Biomulch

Requests to utilize other products shall be submitted to the Engineer for approval before product is used.

The Contractor may use either the processed or unprocessed type of mulch, or some of each on the contract.

Binder (tackifier) may be supplied in liquid, powder or flake form.

## 5.0 CONSTRUCTION METHODS

Mulching shall be carried out at locations identified on the Environmental Protection Plans or as directed by the Engineer, in accordance with the environmental requirements and Work Progression Schedule for the contract.

Mulch applied between May 1st and September 1st may or may not require binder, at the Engineer's discretion. All mulching before May 1st and after September 1st shall require binder. Mulching without binder shall be designated as Mulching 'A', and with binder Mulching 'B'. Binder (tackifier) shall be applied

at the Manufacturer's recommended application rate.

**5.1 Unprocessed Hay or Straw Mulch.** Unprocessed hay or straw mulch shall be spread evenly and uniformly over the designated areas, at a rate of 4500 kg/ha  $\pm$  10%. Lumps and thick clumps of mulch shall be thinned. Binder for Mulching 'B', shall be sprayed uniformly over the mulched ground at the binder Manufacturer's recommended application rate, in a solution of water and enough green dye or green-colored wood-fiber or paper mulch to identify the areas tackified.

**5.2 Processed Hydraulic Mulch.** Processed hydraulic mulch shall be mixed in a hydroseeding unit with water, and for Mulching 'B', with binder at the binder Manufacturer's recommended application rate, and sprayed evenly and uniformly over the designated areas at a rate of 2200 kg/ha  $\pm$  10%.

Rough ground and steep slopes require more mulch and binder per hectare than finished and/or flatter ground, therefore, the Contractor shall adjust application rates within the allowable tolerance to ensure the ground is covered with as much mulch as is necessary.

Remulching of bare spots caused by shifting of the mulch by wind, water or other cause beyond the control of the Contractor will be measured for payment at the unit bid price. Thinning of lumps and thick clumps of mulch and repair of damage to the mulch resulting from the Contractor's operations will not be paid separately but will be considered as incidental to the work.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT.

Measurement for mulching shall be the area in square metres acceptably mulched, and in the case of Mulching 'B', acceptably mulched and tackified, measured along the slope of the ground.

## 8.0 BASIS OF PAYMENT

- Mulching 'A'
- Mulching 'B'

Payment for mulching at the contract unit price shall be full compensation for all labour, equipment and material to do the work.

The supply, mixing, and application of binder and wood-fiber or paper mulch or dye, as specified for Mulching 'B', will not be measured for payment but will be

**Division 7 Environmental Protection**

**Section 6 Mulching**

considered incidental to the work.

operations will not be paid separately but will be considered as incidental to the work.

Thinning of lumps and thick clumps of mulch and remulching of bare spots resulting from the Contractor's

**9.0 WARRANTY**

## Division 7 Environmental Protection

## Section 7 Erosion Control Blankets

## SECTION 7 - EROSION CONTROL BLANKETS

## 1.0 DESCRIPTION

This item shall consist of the supply and placement of erosion control blankets.

## 2.0 REFERENCES

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The Contractor shall submit a request to the Engineer stating the specific blanket planned for use and the Manufacturer's specifications for that blanket. The blanket may only be used upon the approval of the Engineer. If more than one type of blanket is to be used, the location or type of usage shall also be submitted for approval.

## 4.0 MATERIALS

Erosion control blanket shall be of consistent thickness with an even fiber distribution. Blankets shall be supplied in a rolled mat form and be protected with an outer waterproof wrap bearing the Manufacturer's label indicating product name.

**4.1 Jute Erosion Control Blankets.** Jute blankets shall consist of undyed and unbleached 100% natural jute fiber woven mesh. Jute mesh shall meet the following specifications:

- warp ends per metre of width - 60 min.
- waft ends per linear metre - 40 min.
- average mass -  $0.30 \text{ kg/m}^2 \pm 5\%$
- yarn thickness - may not vary by more than one-half its normal diameter

**4.2 Excelsior or Wood Fiber Erosion Control Blankets.**

**4.2.1 Excelsior Blankets.** Excelsior blankets shall consist of a machine produced mat of curled wood excelsior with 80% of the fibers 150 mm, or longer, in length. The fiber shall be of consistent thickness and evenly distributed over the entire area of the blanket. One side of the blanket shall be covered with a biodegradable plastic mesh.

**4.2.2 Wood Fiber Blankets.** Wood Fiber blankets consist of wood fiber bonded to a photodegradable netting, of consistent thickness and evenly distributed over the entire area of the blanket. One side of the blanket shall be bonded to a photodegradable netting.

**4.3 Straw Erosion Control Blankets.** Straw Erosion Control Blankets shall consist of a machine produced mat of straw sewn together with biodegradable plastic

mesh and/or photo degradable netting thread with an average mass of  $0.22 \text{ kg/m}^2$  to  $0.28 \text{ kg/m}^2$

**4.4 Polypropylene Erosion Control Blanket.** Polypropylene Erosion Control Blankets shall consist of polypropylene staple fibres reinforced with a polypropylene netting and shall meet the following specifications.

- chemically inert
- fire retardant (meets flammability test CS191-53)
- minimum weight  $0.02 \text{ kg/m}^2$



**4.5 Staples.** Staples shall be U-shaped and be constructed of wire with a diameter of at least 2.5mm, with legs at least 150mm long and 25mm apart or an approved equal.

## 5.0 CONSTRUCTION METHODS

**5.1 Blanket Placement.** The placement and stapling of erosion control blanket shall follow the application of seed and fertilizer and shall be done on the same day. If soil conditions warrant immediate protection then the Engineer may direct that erosion control blanket placement and stapling precede the application of seed and fertilizer.

Erosion control blankets shall be placed to form a continuous mat and be stapled in position. Excelsior Erosion Control Blanket shall be butted at the edges. Jute and Straw Erosion Control Blankets shall be overlapped on all edges as per the Manufacturer's specifications. Overlap shall be in the direction of drainage flow.

At the top of a slope the erosion control blanket shall be anchored in a 150mm deep by 150mm wide trench. After stapling the trench shall be backfilled and compacted.



The terminal ends of blankets used in ditches and channels shall be anchored in a 150mm deep by 150mm wide trench. After stapling the trench shall be backfilled and compacted.



For placement on slopes which are 3:1 or steeper and which are longer than twice the width of the blanket, the erosion control blanket shall be unrolled perpendicular to the top of fill slopes.

For placement in ditches, the erosion control blanket shall be unrolled parallel to the centerline of the ditch. Blankets unrolled parallel to the centerline shall extend a minimum of 1m up the front and back slopes. Longitudinal joints shall not be within 300 mm of the

**Division 7 Environmental Protection****Section 7 Erosion Control Blankets**

centerline of the ditch.

End joints of adjacent blankets shall be staggered.

**5.2 Stapling.** Erosion control blankets shall be stapled in position as they are placed. Staples shall be driven through the blanket and full length into the ground, perpendicular to the slope.

Stapling shall be carried out in the field as per the manufacturer's specifications.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for erosion control blanket shall be the

area in square metres acceptably installed and in place, measured along the slope of the ground. No additional payment will be made for blanket overlap.

**8.0 BASIS OF PAYMENT**

- Jute Erosion Control Blanket
- Excelsior or Wood Fiber Erosion Control Blanket
- Straw Erosion Control Blanket
- Polypropylene Erosion Control Blanket

Payment at the contract price for the above tender item(s) shall be full compensation for all labour, equipment and material to do the work.

**9.0 WARRANTY**

## Division 7 Environmental Protection

## Section 8 Topsoil

**SECTION 8 - TOPSOIL****1.0 DESCRIPTION**

The Contractor shall, where directed, salvage topsoil during the grubbing operation, stockpile this material (if required) and place on areas designated by the Environmental Construction Plans and/or by the Engineer.

The tendered quantity of topsoil is based on a thickness of 100 mm.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 2 Section 3, Roadway and Drainage Excavation

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

Topsoil shall be the surface layer of soil, free draining and shall be free from subsoil, woody vegetation, stumps, roots or other debris that would prevent proper placement of the topsoil, and shall be free from stones, clay lumps or similar objects larger than 50 mm in greatest dimension. Sod and herbaceous growth such as grass and weeds need not be removed but shall be thoroughly broken up and mixed with the soil during handling operations. The material shall also be free from any material toxic to plant growth.

**5.0 CONSTRUCTION METHODS**

Topsoil shall be removed from construction surfaces

and stockpiled when directed by the Engineer. If space within the right of way is not available for stockpiling of topsoil, the Contractor shall provide suitable areas elsewhere for the duration of the contract.

Areas where topsoil is to be placed shall be fine graded to a uniform surface, shall be free of all vegetation and other debris and free from stones which would not be covered by the specified depth of topsoil.

Topsoil shall be spread to a uniform depth of approximately 100 mm  $\pm$  25 mm on designated areas.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Where topsoil is to be drawn from stockpiles built by the Contractor or from existing stockpiles designated in the contract and placed, measurement shall be made in square metres of surface covered, measured along the slope of the ground.

**8.0 BASIS OF PAYMENT**

Payment for topsoil will be at the contract unit price per square metre which shall be full compensation for all labour, equipment and materials to do the work.

The salvaging and stockpiling of topsoil obtained on site will not be measured for payment but shall be considered as incidental to Division 2 Section 3.

The costs incurred by the Contractor for handling, stockpiling and transporting topsoil will be considered as incidental to the work.

**9.0 WARRANTY**





**Division 7 Environmental Protection****Section 9 Water Control for Bridge Foundations****SECTION 9 - WATER CONTROL FOR BRIDGE FOUNDATIONS****1.0 DESCRIPTION**

This item of work shall consist of the dewatering and control of water for the purpose of placing bridge foundation concrete in the dry.

All work necessary to remove sediment when dewatering shall be the responsibility of the Contractor and at the discretion of the Engineer.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 7 Section 12, Dewatering with Filter Bags

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

Filter Bags shall conform to the requirements for Filter Bags as per Division 7 Section 12 of these specifications.

**5.0 CONSTRUCTION METHODS**

Dewatering shall include the construction of cofferdams, where necessary, as well as pumping, which may involve the use of Filter Bags.

All work necessary to remove sediment when dewatering shall be the responsibility of the Contractor and at the discretion of the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for Water Control For Bridge Foundations shall be by the contract lump sum price necessary to complete work.

**8.0 BASIS OF PAYMENT**

Payment for Water Control for Bridge Foundations shall be full compensation for all costs of labour, plant, tools, equipment, materials (including filter bags), cofferdams, pumping and incidentals necessary to complete the work to the satisfaction of the Engineer.

**9.0 WARRANTY**



## Division 7 Environmental Protection

## Section 10 Turbidity Curtain

## SECTION 10 - TURBIDITY CURTAIN

## 1.0 DESCRIPTION

This item of work shall consist of the supply, installation, maintenance and removal of turbidity curtains.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 4632, Test Method for Determining Grab Tensile Strength.
- ASTM D 4751 (FOS), Test Method for Determining the Filtration Opening Size (FOS) of Geosynthetic.
- Drawings HS709.DWG. and HS710.DWG.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

Turbidity curtains shall consist of turbidity curtain geosynthetic, load line, floatation, ballast, anchors, mooring buoys, mooring lines, adjustment lines, and tie-downs.

**4.1 Geosynthetic Curtain.** Turbidity curtain geosynthetics shall have the following properties:

- be a non-woven or woven material such that the opening size cannot be enlarged under pressure or by being snagged.
- a filtration opening size (FOS) of 220  $\mu\text{m}$ , maximum, for non-woven geotextiles, and a FOS of 425  $\mu\text{m}$ , maximum, for woven geotextiles when tested in accordance with ASTM 4751 (FOS).

**4.2 Fabric Strength.** The following guide for the configuration of the turbidity curtain can be used. The configuration should vary with exposure conditions.

**Suggested Grab Tensile Strength, Minimum  
Average Roll Value (MARV), N**

| 400                        | 700 | 1000 | 1400          |
|----------------------------|-----|------|---------------|
| <b>Exposure Conditions</b> |     |      |               |
| Calm                       | →   |      | Rough         |
| Sheltered                  | →   |      | Exposed       |
| Short duration             | →   |      | Long Duration |
| No flow                    | →   |      | Very Low Flow |
| Shallow (1-3m)             | →   |      | Deep (10 m +) |

|                        |                         |                     |
|------------------------|-------------------------|---------------------|
| CHAIN 8 mm             | Chain<br>→              | 10 mm               |
| MIN 75 cm <sup>2</sup> | Buoyancy x-Section<br>→ | 150 cm <sup>2</sup> |

In a reasonably exposed area that is shallow but curtain will be there for 6 months or more the 1000 to 1400N fabric should be used. In calm, short duration applications that are deep (8 m) then a 400 or 700N fabric should be used. There is no absolute rule.

**4.3 Floatation.** Turbidity curtain floatation material shall be a material which has sufficient buoyancy to provide the curtain with continuous support, and a minimum of 100 mm freeboard. The sections of floatation shall be installed such that they can not move along inside the sleeve and they shall not be more than twice the thickness of the floatation apart.

**4.4 Load Lines.** Load lines shall be minimum 8 mm steel cable, or rope of equal strength.

**4.5 Ballast.** Ballast shall be minimum 8 mm steel chain.

**4.6 Anchors.** Turbidity curtain anchors shall have a minimum mass of 34 kg for firm mud bottoms or self burying anchors with a minimum mass of 5 kg for sandy bottoms.

**4.7 Mooring Buoys.** Mooring buoys shall have provision for the mooring line to be securely attached and be sufficiently buoyant to remain afloat under normal load conditions.

**4.8 Mooring Lines.** Adjustment lines shall be minimum 13 mm nylon rope.

## 5.0 CONSTRUCTION METHODS

**5.1 Turbidity Curtains.** Turbidity curtains shall be constructed as follows:

- The turbidity curtain shall have sleeves formed along the top and bottom edges. The top sleeve shall contain the load line and the floatation, and the bottom sleeve shall contain the ballast. The bottom sleeve shall be reinforced with 550 g PVC if the curtain is to be deployed for longer than 2 weeks or if it is in an exposed location.
- Where the turbidity curtain is joined to provide a continuous run, the sections shall be connected to provide a continuous seal.
- The turbidity curtain shall be of sufficient width taking into account water depth and wave action.
- Adjustment lines, when required, shall be used at 10 m intervals maximum and encircle the turbidity curtain from top to bottom.

**Division 7 Environmental Protection****Section 10 Turbidity Curtain**

- The turbidity curtain shall be prepared for installation by rolling up and binding with ties every 1.5 m for the entire length of curtain.

**5.2 Installation**

Turbidity curtains shall be installed as follows:

- Anchor locations shall be established by the installer as necessary to maintain the turbidity curtain in place. The number and size of the anchors and their location to be determined by the size of the curtain and its location (sheltered or exposed) and the duration for which it will be deployed.

Turbidity curtains shall be installed to prevent sediment passage from the area enclosed by the curtain to the remaining water body. Turbidity curtains shall only be installed and maintained in a manner that avoids entry of equipment, other than hand-held equipment and boats, to the remaining water body. The sequence of installation shall be as follows:

- One end of the curtain shall be firmly attached to the upstream tie-down.
- The curtain shall be launched and placed as specified.
- The remaining end of curtain shall be attached to the downstream tie-down.
- Each anchor shall be attached to the turbidity curtain load line with a mooring line.
- At inflection points, the mooring buoys shall be attached to the mooring line at a distance 1 m from the load line.

- The ties, if used, shall be removed from the curtain to allow the turbidity curtain ballast to sink to its maximum depth.
- The location and depth of the ballast shall be adjusted as necessary by using the adjustment lines.

Equipment is permitted to work in the area enclosed by the turbidity curtain.

The curtain shall be kept free of tears and gaps and the bottom edge of curtain shall be continuously in contact with the water course bed so that sediment passage from the enclosed area is prevented. The entire top edge of the curtain shall be maintained such that it is always above the water surface.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for turbidity curtains shall be by the metre of curtain installed, from tie-down to tie-down.

**8.0 BASIS OF PAYMENT**

Payment at the contract unit price for the above tender item shall be full compensation for all labour, equipment and material required to do the work. Partial payment will be made on the following basis:

- 70% for installation
- 30% for maintenance and removal

**9.0 WARRANTY**



## Division 7 Environmental Protection

## Section 11 Water Control at Culvert Extensions or Installations

**SECTION 11 - WATER CONTROL AT CULVERT EXTENSIONS OR INSTALLATIONS****1.0 DESCRIPTION**

This item of work shall consist of the dewatering and control of water for the purpose of installing culverts and extending culverts in the dry. Work shall be in accordance with the Nova Scotia Watercourse Alteration Specifications and the conditions of this specification.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 3 Section 4, Clear Stone.
- Division 7 Section 12, Dewatering with Filter Bags.
- Nova Scotia Watercourse Alteration Specifications (1993)

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

C1 Clear Stone as per Division 3 Section 4 of these specifications shall be used as shown on the plans or as directed by the Engineer.

Filter Bags shall conform to the requirements for Filter Bags as per Division 7 Section 12 of these specifications.

**5.0 CONSTRUCTION METHODS****5.1 General**

Water control for culvert installations or extensions shall be carried out using one of the following methods:

- constructing a temporary plastic, geotextile or stone rip rap lined diversion or
- pumping the stream flow around the site.

The following two conditions shall be satisfied and approved by the Engineer before any work on the installation or extension of culverts can commence:

- The Contractor shall install a geotextile silt fence across the right-of-way on both sides of the watercourse to delineate a minimum buffer zone of 75 m or as directed by the Engineer.
- The Contractor shall construct sediment traps at the ends of the culvert or culvert extension to the dimensions indicated on the Environmental

Construction Plan.

Other requirements are as follows:

- No grubbing or filling is to take place until the drainage structure and the erosion control devices are installed.
- Access roads or working areas within the buffer zone shall be constructed of rock fill. If a common fill is used then all exposed surfaces shall be covered concurrently with 200 mm minus Clear Stone.

**5.2 Temporary Diversions**

If a temporary plastic, geotextile or stone rip rap lined diversion is to be constructed then the following procedures shall be adhered to:

- Excavate diversion channel leaving earthen plugs at both ends. Line diversion channel with plastic, geotextile or uniformly-graded stone rip rap material in accordance with Clause C16 in the "Culverts" section of the Nova Scotia Watercourse Alteration Specifications.
- Open downstream plug and allow water pressure to equalize in the stream diversion.
- Open upstream plug and allow water to flow through both the existing stream channel and the new stream channel.
- Immediately place a non-erodible dam in the upstream end of the existing channel. Dam to consist of a plastic faced sand bag cofferdam.
- Immediately install a non-erodible dam downstream to prevent back flow into the construction site. Construct a settlement pond and pump out the existing dammed-off stream channel. All water from the existing channel must be filtered before entering the live stream by means of the settlement pond or some other procedure approved by the Engineer.
- Construct drainage structure and complete all channel work.
- Remove the settlement pond and remove downstream dam.
- Remove upstream dam. Fill in upstream and downstream ends of temporary stream diversion with non-erodible material.
- Fill in remainder of stream diversion and stabilize.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for water control shall be by the lump sum price for the dewatering and control of water necessary to install or extend culverts in the dry.

**Division 7 Environmental Protection****Section 11 Water Control at Culvert Extensions or Installations****8.0 BASIS OF PAYMENT**

Payment for water control will be at the contract lump bid sum price which price shall be full compensation for all water control associated with pumping the stream flow around a site or for constructing a temporary diversion channel. This work shall include the excavation and in-filling of diversion channel and settlement pond, the supply and placement of channel

lining, the supply, placement and removal of sandbag cofferdam and the non-erodible dam, and all necessary pumping including the supply of filter bags (if required). 200 mm minus Clear Stone, will be weighed and payment will be as per Division 3 Section 4.

**9.0 WARRANTY**

## Division 7 Environmental Protection

## Section 12 Dewatering with Filter Bags

**SECTION 12 - DEWATERING WITH FILTER BAGS****1.0 DESCRIPTION**

This item of work shall consist of all work necessary to remove sediment when dewatering an excavation by pumping water into Filter Bags.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- ASTM D 4632, Test Method for determining grab tensile strength.
- ASTM D 4751, Test Method for Determining the Filtration Opening Size (FOS) of Geosynthetic.
- Division 7 Section 9, Water Control for Bridge Foundations
- Division 7 Section 11, Water Control at Culvert Extensions or Installations.

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

Filter Bags shall comprise a geosynthetic main body complete with a hose connection apparatus.

**4.1 Body Material.** Filter Bags shall have the following properties:

- A grab tensile strength that meets the specifications outlined in ASTM D 4632
- Be a spunbound needle punched fabric between 8 and 16 oz. or woven material such that the hole size can not enlarge under pressure or by being snagged.
- A filtration opening size that meets the specifications outlined in ASTM D 4751.

**2.2 Hose Connection.** The connection shall be adjustable to accept different size discharge hoses.

**2.3 Thread.** The main body shall be sewn with CSB heavy duty nylon thread.

**2.4 Stitching.** The stitching shall conform with the following requirements:

- The center seam of the main body shall be sewn with 4 rows of lockstitch 301.
- The hose connector shall be sewn to the main body with 6 rows of lockstitch 301.

**5.0 CONSTRUCTION METHODS**

Bags shall be raised off the ground by placing on wooden pallets. If this is not possible then bags shall be placed on bedding approved by the Engineer. In all cases the location of the Filter Bags during the dewatering operation will be at the discretion of the Engineer.

It may be necessary to use multiple bags with a manifold on the discharge hose (especially if smaller bags are used) for long term use or for large variations in flow rates.

Bags shall be emptied and collected material disposed of in an area selected by the Contractor and approved by the Engineer. If material is contaminated the Contractor shall ensure that disposal of material meets the requirements of the Dangerous Goods Management Regulations.

Bags may be restitched and reused at the discretion of the Engineer.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE****7.0 METHOD OF MEASUREMENT**

Measurement for Dewatering Filter Bags shall be by the lump sum price for dewatering the excavation specifically denoted on the contract drawings and described in the Special Provisions.

**8.0 BASIS OF PAYMENT**

Payment will be at the lump sum contract price which shall be full compensation for the supply of all pumps and all operating and maintenance costs associated with pumping necessary for dewatering the excavation, for the supply of all Filter Bags, clean-out and disposal of collected sediment to the requirements noted in this specification, and the supply and installation of all appurtenances (if multiple bags used) which price shall include all materials, labour and equipment necessary to do the work to the satisfaction of the Engineer.

The fabric weight and size of main body (length and width) of the Filter Bags and the number of Filter Bags required to do the work shall be the responsibility of the Contractor. The heavier the fabric the smaller the filtration opening size, FOS.

**9.0 WARRANTY**



## Division 7 Environmental Protection

## Section 13 Sodding

## SECTION 13 - SODDING

## 1.0 DESCRIPTION

This item of work shall consist of the supply and placement of all materials necessary for the preparation and the sodding of the side slopes of the approach fills, at the end bents of structures, medians, boulevards, between curb and sidewalk, or other areas as indicated on the plans and/or as directed by the Engineer.

## 2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Canadian Nursery Trades Association; Section 17, Canadian Standards for Nursery Stock.
- Division 7 Section 8, Topsoil.

## 3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

## 4.0 MATERIALS

**4.1 Topsoil.** Topsoil shall conform to the specifications found in Division 7 Section 8 of these specifications.

**4.2 Sod.** Sod shall be cultivated turf grass containing not less than 40% Kentucky Bluegrass and shall be free of weeds and having no surface soil visible when mowed to a height of 50 mm. The soil portion shall be of uniform thickness of not more than 15 mm and conform to Section 17 of the Canadian Standards for Nursery Stock.

**4.3 Pegs.** Pegs shall be wood with a nominal size of 25 mm x 25 mm x 200 mm.

**4.4 Mesh.** Mesh shall be 37 mm chicken wire or plastic mesh.

## 5.0 CONSTRUCTION METHODS

The Contractor shall grade the side slopes to the lines indicated on the plans or as directed by the Engineer and shall check the slope utilizing a template, line or other means to insure a uniform slope. The Contractor shall rake the slopes and place at least 75 mm of approved topsoil under the sod. Lime shall be spread on the topsoil at the rate of 0.25 kg/m<sup>2</sup> and 6-12-12 fertilizer at the rate of 0.15 kg/m<sup>2</sup>.

The sod shall be laid and tamped to a uniform and even surface with broken joints and shall be well watered at least twice a day for seven days after laying and shall be watered for an additional 14 days as required to ensure growth at the end of this period. Sodding on slopes shall be suitably pegged with wooden pegs and provided with wire mesh if and where directed. Any sod which shows signs of settlement shall be cut out and replaced at the Contractor's expense. All excess earth, stones or other debris shall be removed by the Contractor when sodding is completed.

## 6.0 QUALITY CONTROL / QUALITY ASSURANCE

## 7.0 METHOD OF MEASUREMENT

The quantity to be paid for shall be the area in square metres of accepted growing in place sod as determined by measurements made along the surface contours of the ground.

## 8.0 BASIS OF PAYMENT

Payment for sodding will be made at the contract unit price per square metre for Sodding, which price shall include the supplying and placing of topsoil sod, pegs, stakes, wire, pegging, tamping, lime, fertilizer, sprinkling, and all incidentals necessary to complete the work all to the satisfaction of the Engineer.

## 9.0 WARRANTY





## Division 7 Environmental Protection

## Section 14 Lime

**SECTION 14 - LIME****1.0 DESCRIPTION**

This item deals with the supply and application of lime prior to hydroseeding operations.

**2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- Division 7 Section 5, Hydroseeding
- Division 7 Section 8, Topsoil.

**3.0 SUBMISSIONS AND DESIGN REQUIREMENTS****4.0 MATERIALS**

Lime shall be agricultural quality lime. The lime shall be free flowing and free of lumps. The Contractor shall supply the lime.

**5.0 CONSTRUCTION METHODS**

Surfaces that are to be treated with lime shall be shaped and scarified in accordance with surface preparation prior to hydroseeding in accordance with Division 7 Section 5.

For areas where topsoil is to be placed, the surfaces that are to be treated with lime shall be shaped and scarified in accordance with surface preparation required prior to hydroseeding in accordance with Division 7, Section 5 and Division 7, Section 8.

The Engineer shall designate the boundaries of the lime treatment. These areas will include a one (1) metre wide overlap over adjoining vegetation so as to eventually provide a continuous cover of vegetation.

No area shall be limed until the surface preparation has been completed to the approval of the Engineer.

The lime shall be applied at the even rate of  $0.7 \text{ kg/m}^2$  ( $7.0 \text{ t/ha}$ ), for example, or at such rate, or rates, as the Engineer may designate. The lime shall be applied using the hydroseeding equipment. Spreading by hand

will not be allowed.

The lime shall be applied before hydroseeding, in a separate operation from the hydroseeding operation.

**6.0 QUALITY CONTROL / QUALITY ASSURANCE**

The Contractor shall ensure that the lime does not contaminate watercourses.

Lime has been found to cause corrosion of galvanized metal in guard rail. The Contractor shall take all reasonable care to prevent the contamination of: structures, signs, guard rails, fences utilities and all such installations. Should contamination by lime occur, then the Contractor shall remove the contaminating lime, to the satisfaction of, and by means approved by the Engineer.

**7.0 METHOD OF MEASUREMENT.**

Measurement for payment shall be by means of the weight of lime used measured in tonnes rounded to one decimal place.

When the lime arrives in pre-weighed bags, the weight shall be determined by counting the bags of lime used.

Where the lime arrives in loose form, then the lime shall be weighed at the Contractor's expense.

**8.0 BASIS OF PAYMENT**

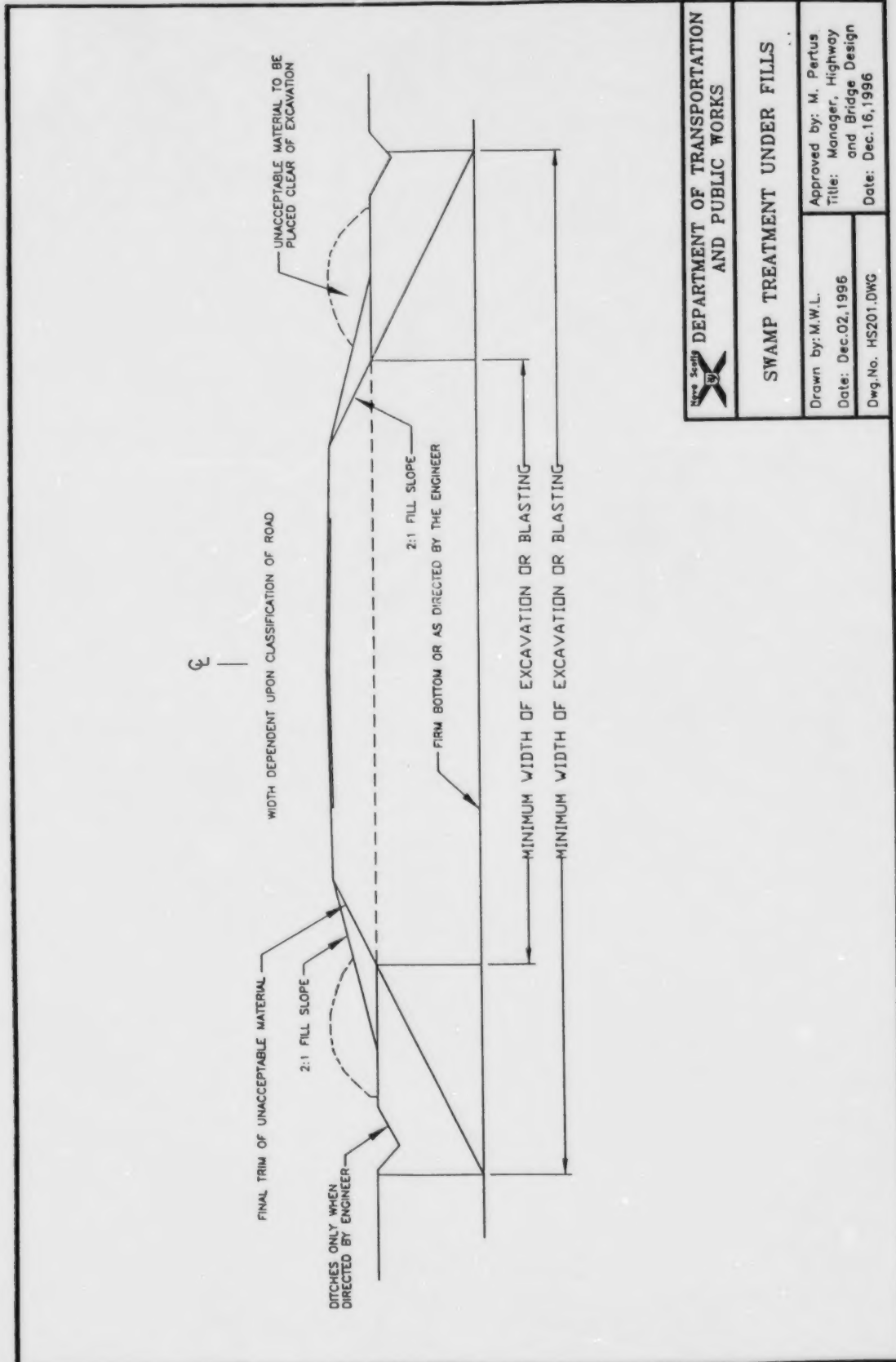
Payment at the contract unit price for Lime for hydroseeding shall be full compensation for all labour, materials and use of equipment, including the weighing of lime if necessary to ensure the application of lime is carried out in conformation with this specification.

Preparation of slopes including shaping and scarifying for liming will not be measured for payment, but shall be considered as incidental to the bid items under which the excavation or embankment construction of such areas was carried out.

**9.0 WARRANTY**



Division 8 Standard Drawings

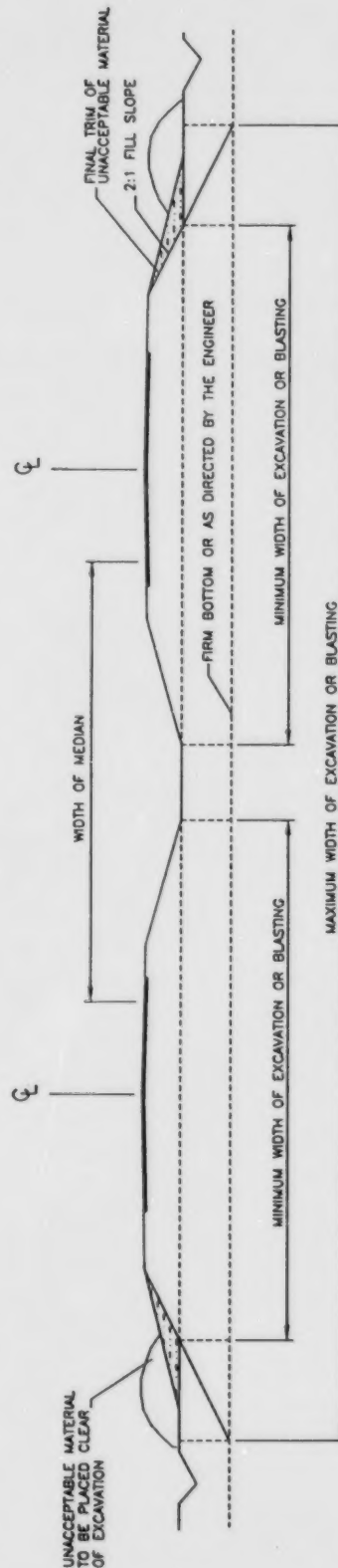
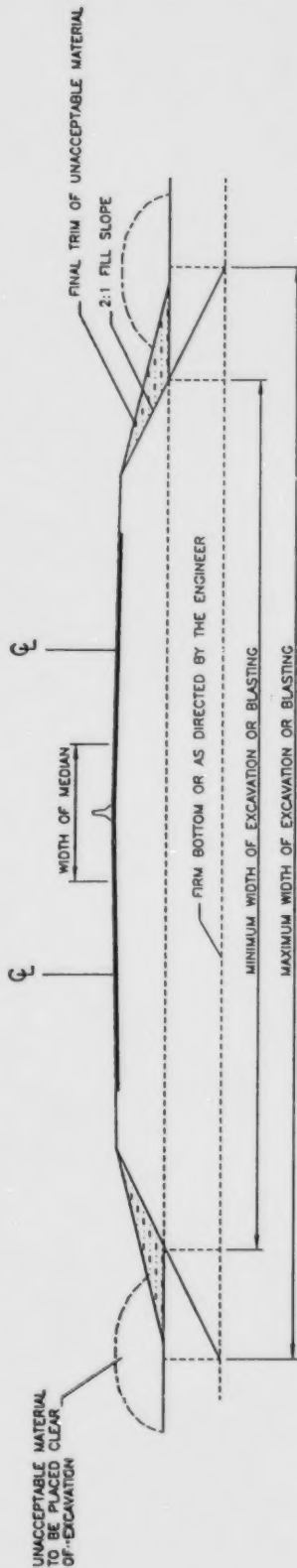


DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

SWAMP TREATMENT UNDER FILLS

|                   |                                           |
|-------------------|-------------------------------------------|
| Drawn by: M.W.L.  | Approved by: M. Pertus                    |
| Date: Dec.02,1996 | Title: Manager, Highway and Bridge Design |
| Dwg.No. HS201.DWG | Date: Dec.16,1996                         |

## Division 8 Standard Drawings

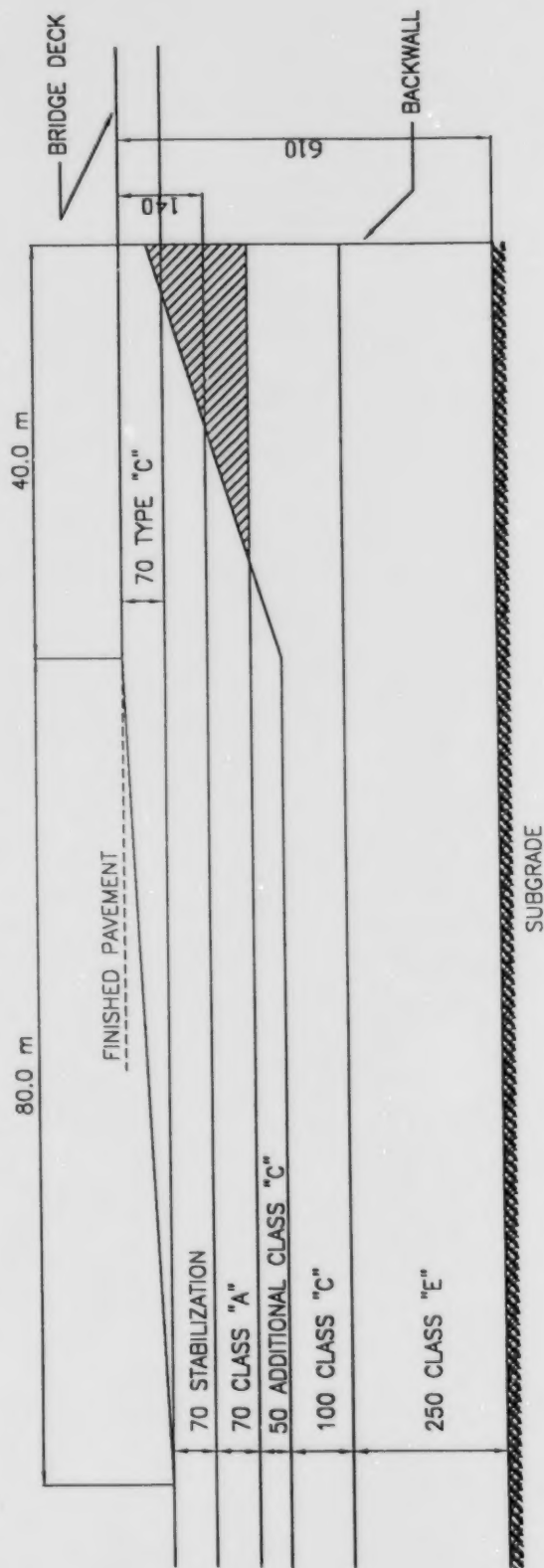


|                                                                                                                                      |                                              |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
|  DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC WORKS |                                              |
| SWAMP TREATMENT UNDER FILLS<br>NARROW & WIDE MEDIAN                                                                                  |                                              |
| Drawn by: M.W.L.                                                                                                                     | Approved by: M. Pertus                       |
| Date: Dec. 02, 1996                                                                                                                  | Title: Manager, Highway<br>and Bridge Design |
| Dwg. No. HS202.DWG                                                                                                                   | Date: Dec. 16, 1996                          |



## Division 8 Standard Drawings

## PAVING APPROACH TO BRIDGES



## NOTES

- 1 CLASS "C" IN TEMPORARY PORTION OF RAMP TO BE REMOVED PRIOR TO CLASS "A" STABILIZATION.
- 2 ALL DIMENSIONS IN MILLIMETRES EXCEPT WHERE NOTED.

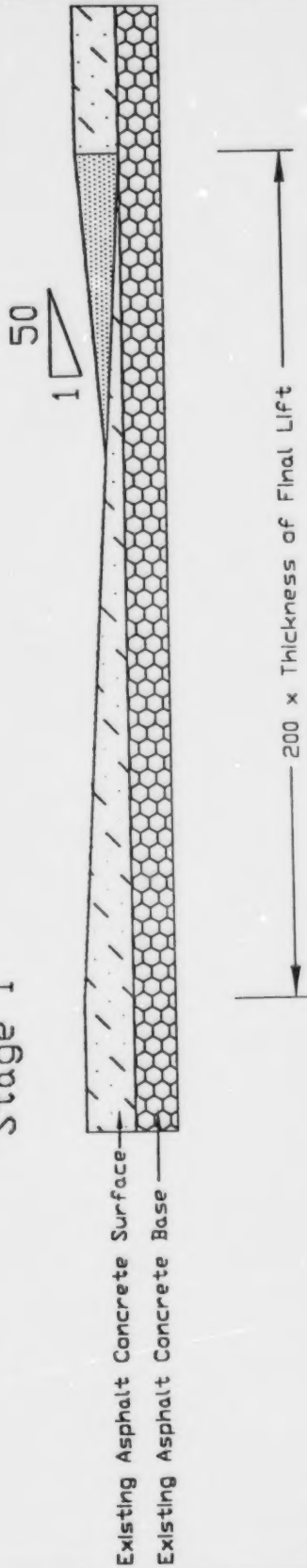
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## PAVING APPROACH TO BRIDGES

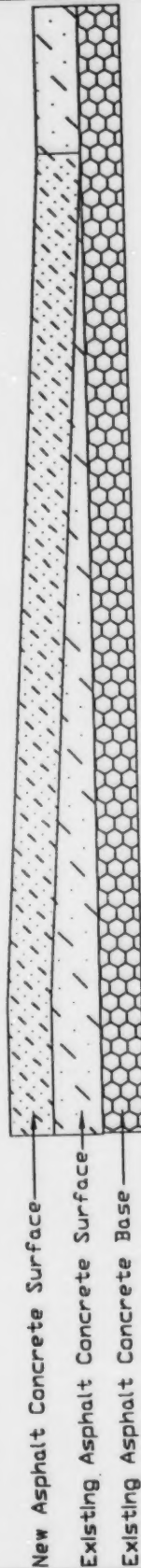
|                   |                                           |
|-------------------|-------------------------------------------|
| Drawn by: M.W.L.  | Approved by: M. Pertus                    |
| Date: Dec.02,1996 | Title: Manager, Highway and Bridge Design |
| Dwg.No. HS401.DWG | Date: Dec.16,1996                         |

Division 8 Standard Drawings

Stage 1



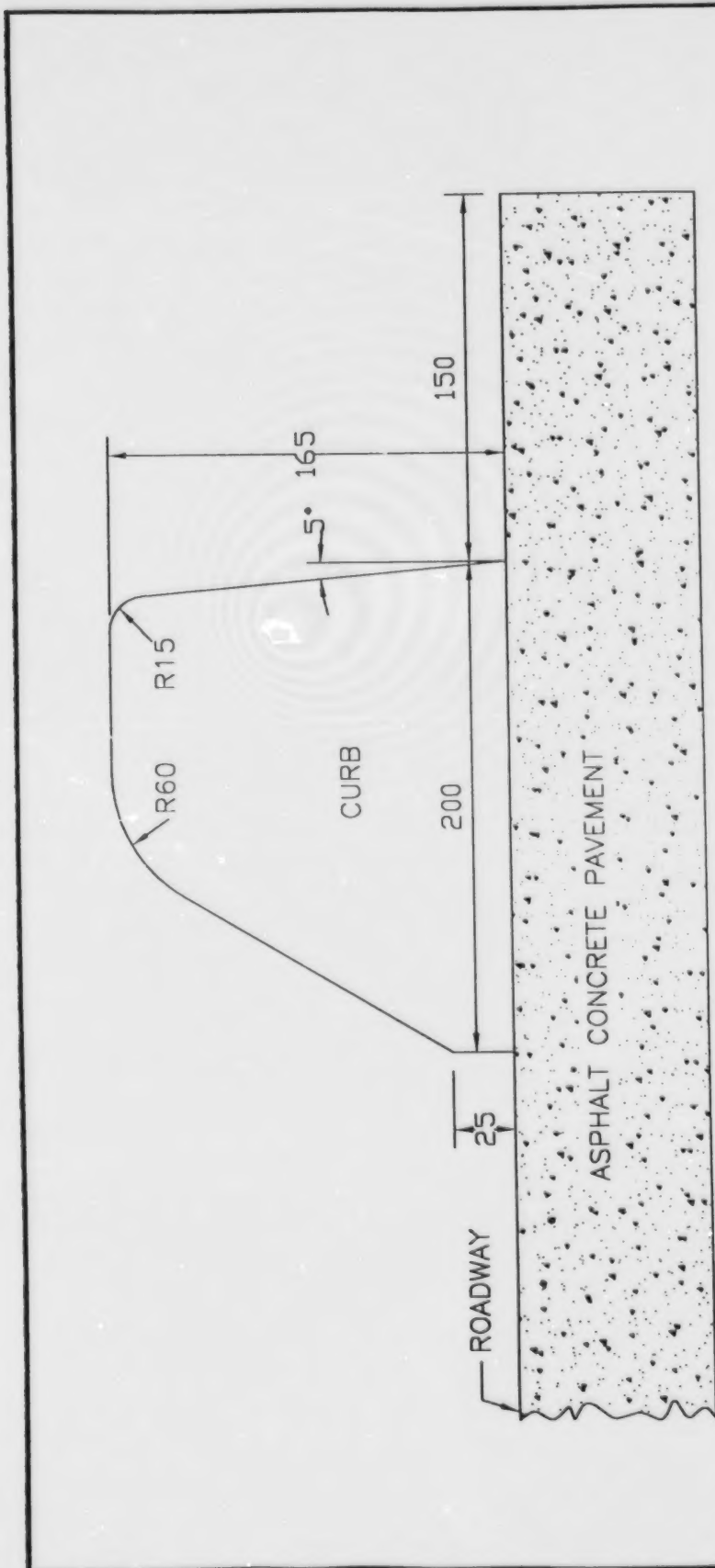
Stage 2



Scale: N.T.S.

|                                                                                                                                    |                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
|  DEPARTMENT OF TRANSPORTATION<br>& PUBLIC WORKS |                                                                        |
| TRANSVERSE KEY JOINT                                                                                                               |                                                                        |
| Drawn by: M.W.L.<br>Date: Dec.02,1996                                                                                              | Approved by: M. Partus<br>Title: Manager, Highway<br>and Bridge Design |
| Dwg.No. HS404.DWG                                                                                                                  | Date: Dec.16,1996                                                      |

Division 8 Standard Drawings



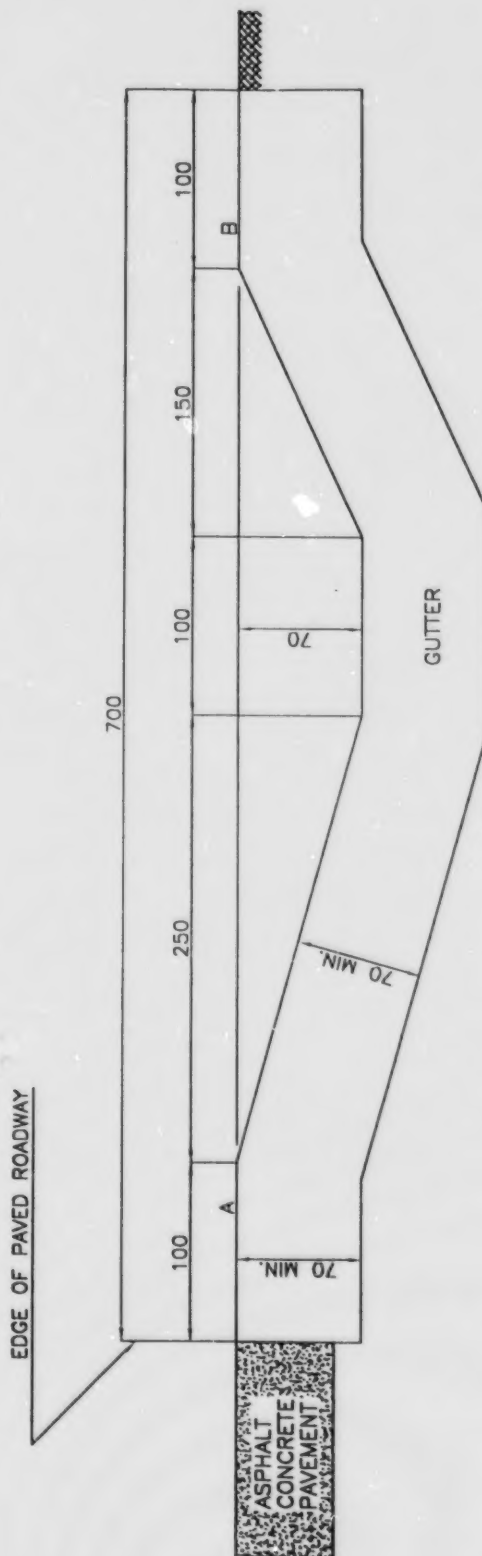
NOTE: ALL DIMENSIONS IN MILLIMETRES

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

ASPHALT CONCRETE CURB

|                   |                                           |
|-------------------|-------------------------------------------|
| Drawn by: M.W.L.  | Approved by: M. Pertus                    |
| Date: Dec.02,1996 | Title: Manager, Highway and Bridge Design |
| Dwg.No. HS402.DWG | Date: Dec.16,1996                         |

## Division 8 Standard Drawings



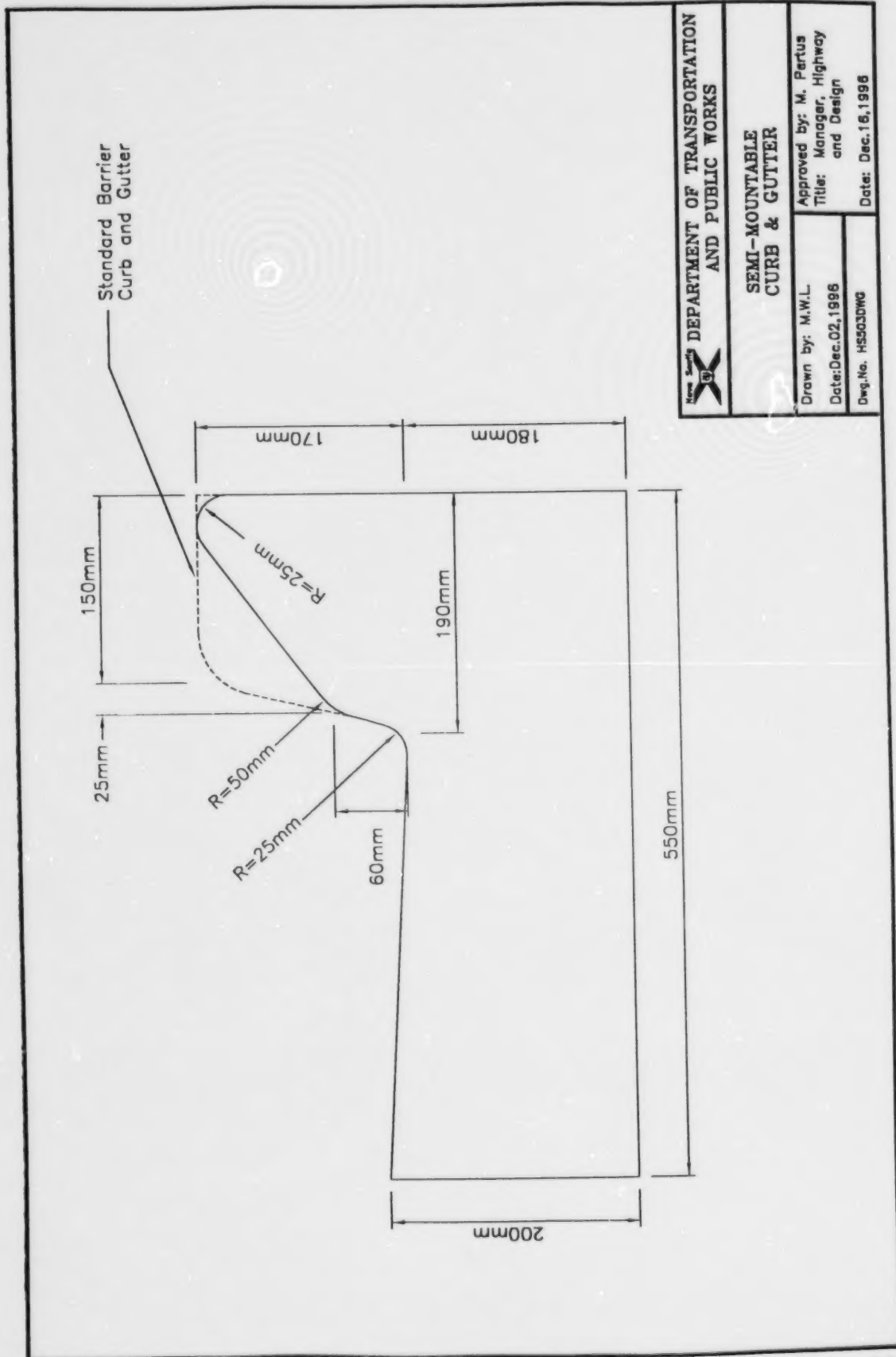
- NOTES:
- (1) RATE OF SLOPE A TO B TO BE EQUAL TO RATE OF SLOPE OF ROADWAY SURFACE.
  - (2) OFFTAKES ARE TO BE CONSTRUCTED AT LOCATIONS SPECIFIED BY THE ENGINEER AND ARE TO EXTEND TO THE EDGE OF SHOULDER AND DOWN THE SLOPE 1 m MINIMUM.
  - (3) ALL DIMENSIONS ARE IN MILLIMETRES.

**DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS**

**ASPHALT CONCRETE GUTTER**

|                     |                                           |
|---------------------|-------------------------------------------|
| Drawn by: M.W.L.    | Approved by: M. Pertus                    |
| Date: Dec. 02, 1996 | Title: Manager, Highway and Bridge Design |
| Dwg. No. HS403.DWG  | Date: Dec. 16, 1996                       |

## Division 8 Standard Drawings



**DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS**

**SEMI-MOUNTABLE CURB & GUTTER**

Drawn by: M.W.L.

Approved by: M. Partus  
Title: Manager, Highway  
and Design

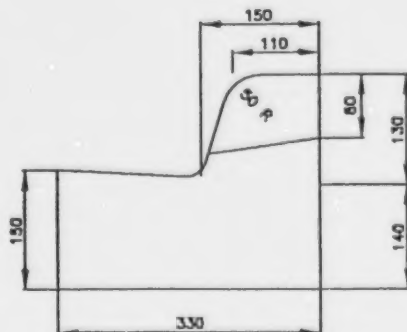
Date: Dec. 02, 1996

Date: Dec. 16, 1996

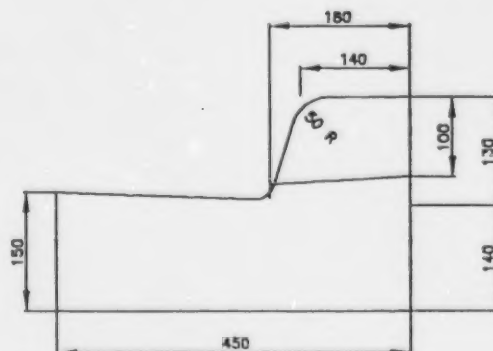
Dwg. No. HS9630W6



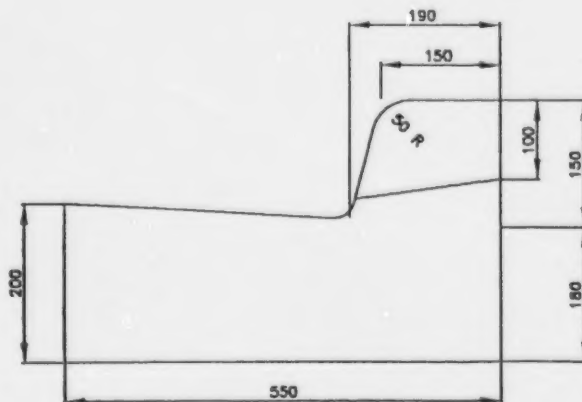
## Division 8 Standard Drawings



TYPE "A"



TYPE "B"



TYPE "C"

## NOTES:

- 1 CURBS AND CURB AND GUTTER SHALL BE BUILT ON AN APPROVED GRANULAR BASE HAVING A MINIMUM DEPTH OF 150 mm.
- 2 EXPOSED EDGES SHALL BE FINISHED WITH A ROUNDED TOOL TO PRODUCE A 25 mm RADIUS OR AS SHOWN.
- 3 ALL DIMENSIONS ARE IN MILLIMETRES.

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## CONCRETE CURB DETAIL

Drawn by: M.W.L.

Date: Dec. 02, 1998

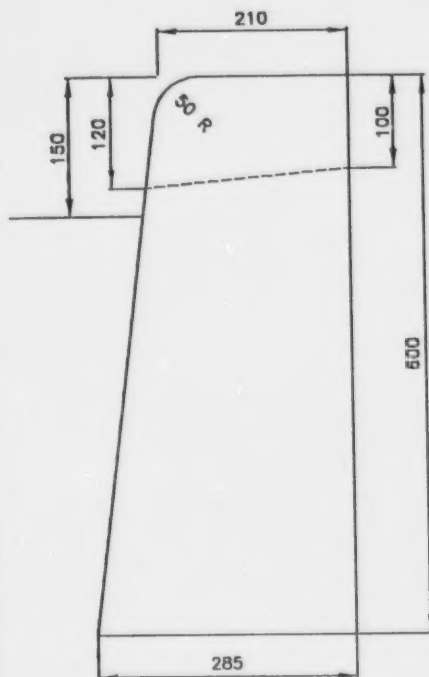
Dwg. No. HS504.DWG

Approved by: M. Pertus

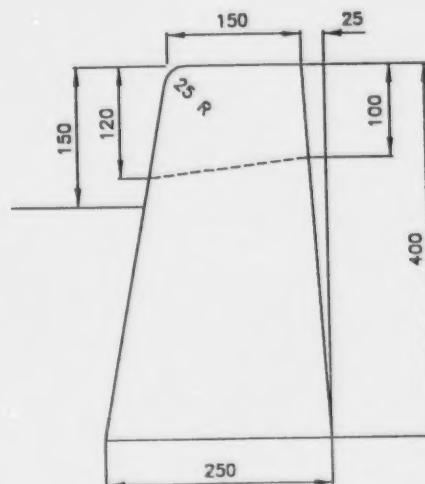
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1998

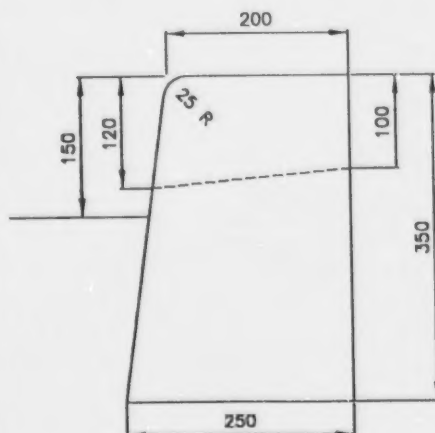
## Division 8 Standard Drawings



TYPE "D"



TYPE "E"



TYPE "F"

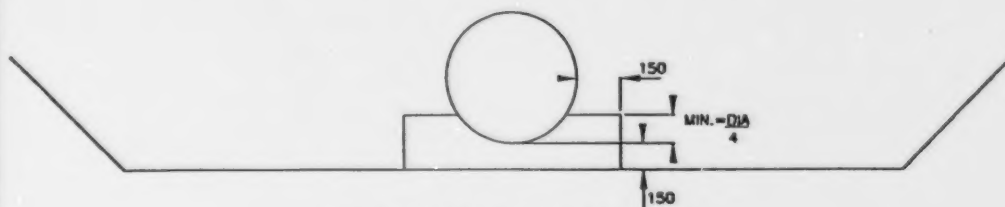
## NOTES:

- 1 CURBS AND CURB AND GUTTER SHALL BE BUILT ON AN APPROVED GRANULAR BASE HAVING A MINIMUM DEPTH OF 150 mm.
- 2 EXPOSED EDGES SHALL BE FINISHED WITH A ROUNDED TOOL TO PRODUCE A 25 mm RADIUS OR AS SHOWN.
- 3 ALL DIMENSIONS ARE IN MILLIMETRES.

|                                                                                                                                              |                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|  <b>DEPARTMENT OF TRANSPORTATION<br/>AND PUBLIC WORKS</b> |                                                                                               |
| <b>CONCRETE CURB DETAIL</b>                                                                                                                  |                                                                                               |
| Drawn by: M.W.L.<br>Date: Dec. 02, 1996<br>Dwg. No. HS505.DWG                                                                                | Approved by: M. Pertus<br>Title: Manager, Highway<br>and Bridge Design<br>Date: Dec. 16, 1996 |

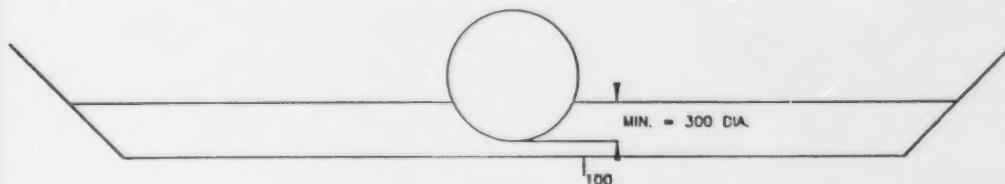
## Division 8 Standard Drawings

## CLASS "A" BEDDING

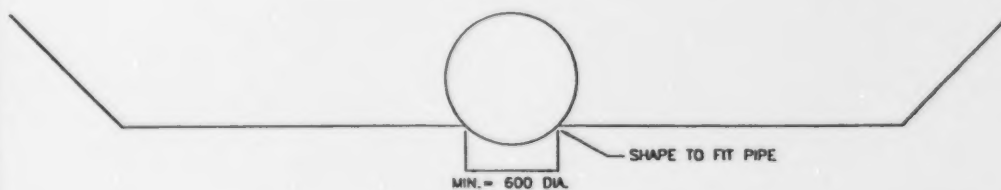


NOTE: CRUSHED STONE OR GRAVEL INSTEAD OF  
CONCRETE PERMITTED ON ROCK FOUNDATION.  
METHOD OF LAYING AS PER CLASS "B" BEDDING.

## CLASS "B" BEDDING



## CLASS "C" BEDDING



ALL DIMENSIONS ARE IN MILLIMETRES



DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## BEDDING DETAILS FOR LAYING PIPE

Drawn by: M.W.L.

Date:

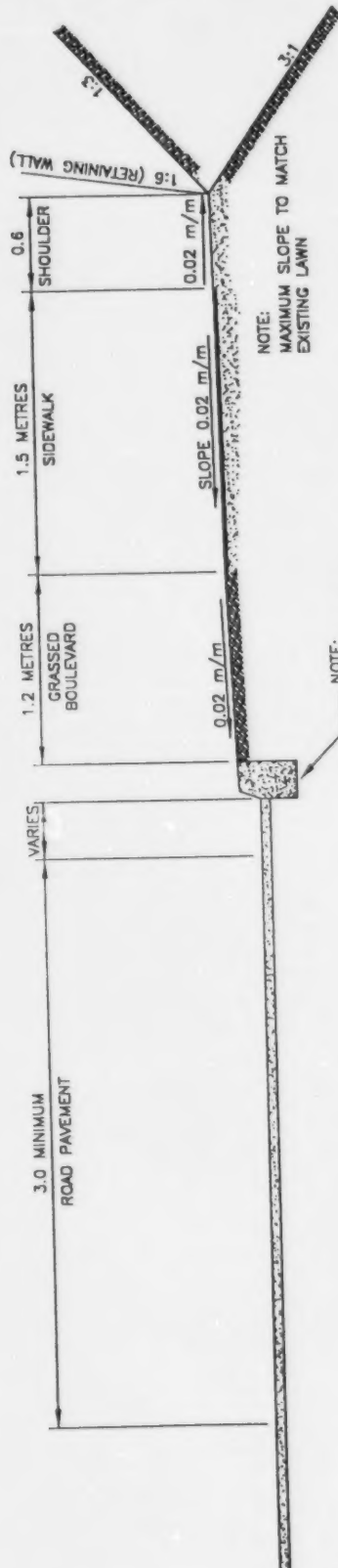
Spec.Dwg.No. HS506.DWG

Approved by: M. Pertus

Title: Manager, Highway  
and Bridge Design

Date: Dec.16,1996

## Division 8 Standard Drawings



## SECTION

ON CLASS ULU 30 HIGHWAY

## NOTES

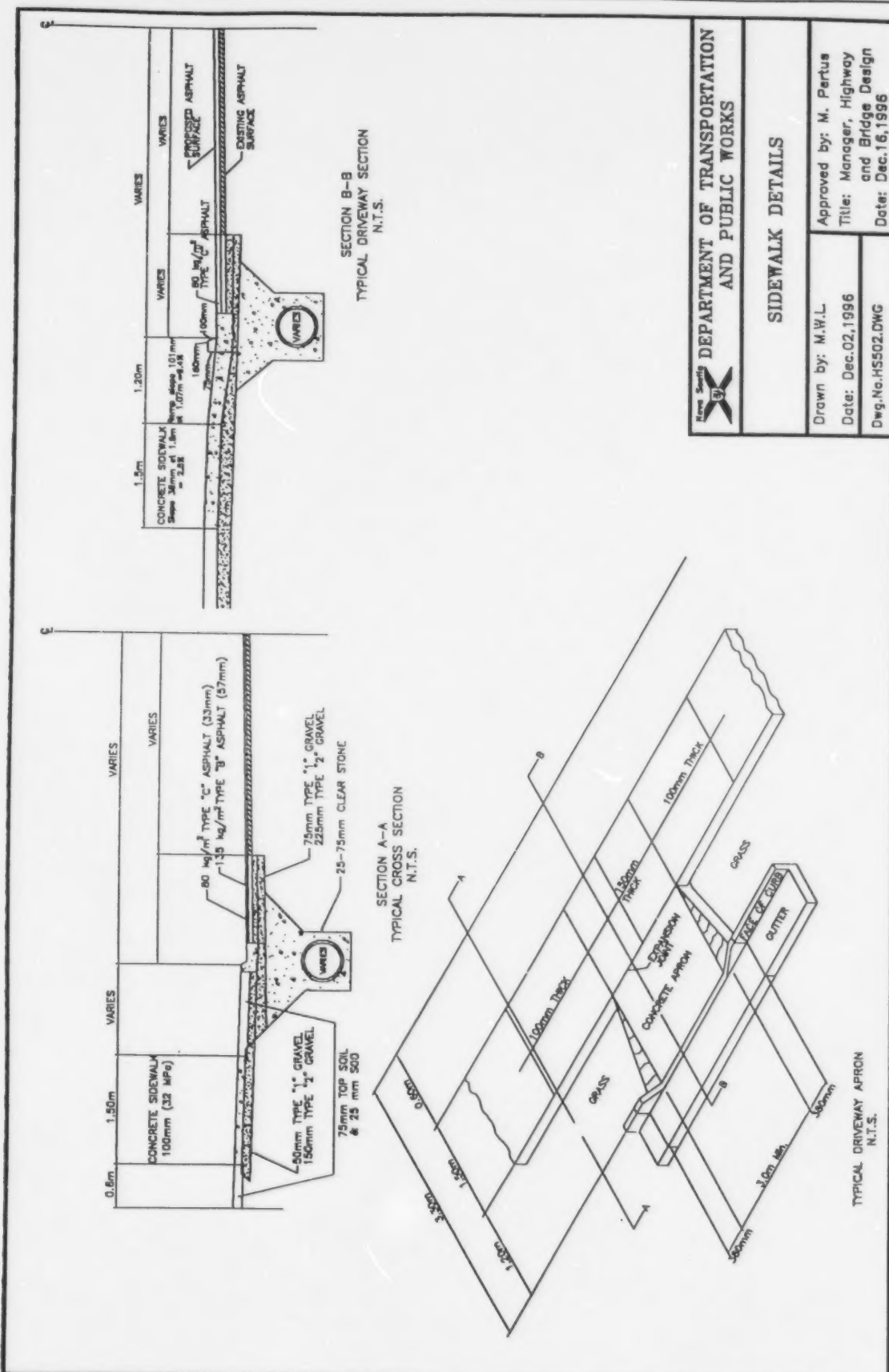
1. ON CLASS UCU 50 HIGHWAYS PROVIDE AN ADDITIONAL 3.0m PAVED PARKING LANE.
2. SEE PLAN HS402.DWG FOR ASPHALT CURB DETAILS.  
SEE PLAN HSS04.DWG & HSS05.DWG FOR CONCRETE CURB DETAILS.


 DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## SIDEWALK DETAILS

|                     |                                           |
|---------------------|-------------------------------------------|
| Drawn by: M.W.L.    | Approved by: M. Pertus                    |
| Date: Dec. 02, 1996 | Title: Manager, Highway and Bridge Design |
| Dwg. No. HSS01.DWG  | Date: Dec. 16, 1996                       |

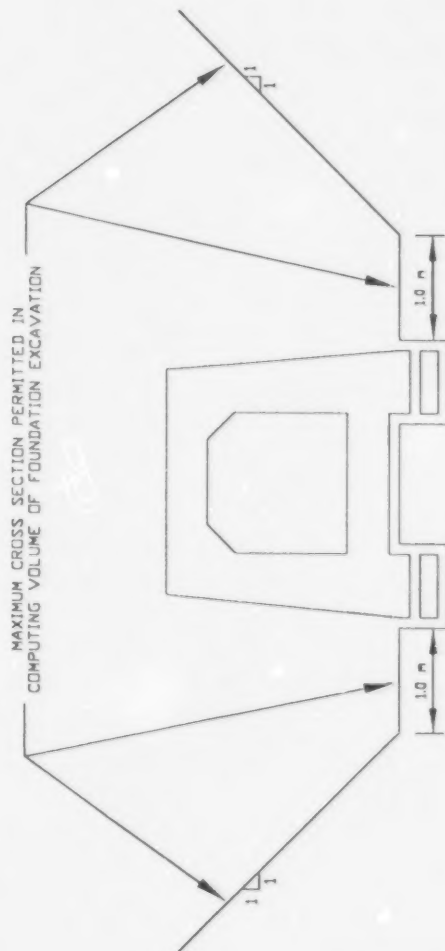
## Division 8 Standard Drawings





## Division 8 Standard Drawings

EXCEPT IN THOSE CASES WHERE DIMENSIONS FOR EXCAVATION ARE INDICATED ON INDIVIDUAL PLANS, THE DIMENSIONS USED IN COMPUTING THE SECTIONAL AREA OF FOUNDATION EXCAVATION FOR CULVERTS OF ALL SIZES WILL BE AS SHOWN ON THE FOLLOWING CROSS SECTION.



ADD FOR SIDE AND END APRONS

### CONCRETE CULVERT

ILLUSTRATIVE OF ALL SIZES  
(SIMILARLY FOR CREOSOTED LUMBER AND TIMBER CULVERTS)

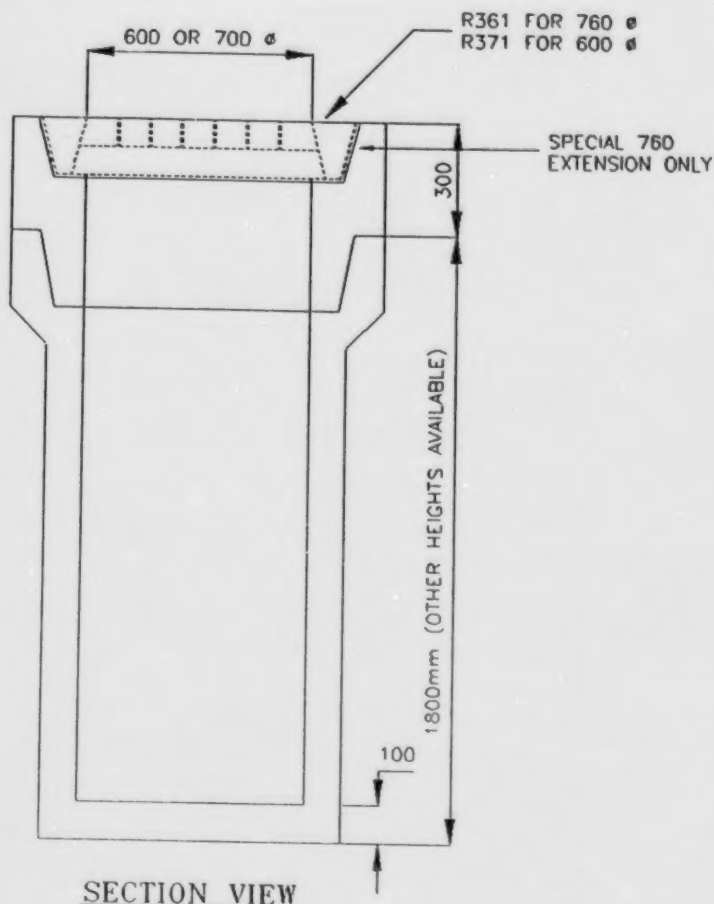
THIS CROSS SECTION IS THE MAXIMUM PERMITTED. IF THE BOTTOM WIDTH OF THE EXCAVATION IS LESS OR IF THE SIDE SLOPES ARE STEEPER THAN INDICATED ON THE FOREGOING CROSS SECTION, THE SECTIONAL AREA WILL BE COMPUTED ACCORDINGLY.

**DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS**

### FOUNDATION EXCAVATION FOR CULVERTS

|                     |                                           |
|---------------------|-------------------------------------------|
| Drawn by: M.W.L.    | Approved by: M. Partus                    |
| Date: Dec. 02, 1996 | Title: Manager, Highway and Bridge Design |
| Dwg. No. HS203.DWG  | Date: Dec. 16, 1996                       |

## Division 8 Standard Drawings



## NOTES:

1. MINIMUM SUMP 450mm.
2. 1 LEAD ONLY.
3. MAXIMUM LEAD SIZE 375mm.
4. REQUIRED COVER R361 (760mm dia.) OR COVER R371 (600mm dia.) OR EQUIVALENTS.
5. IT IS SUGGESTED THAT THIS CATCH BASIN BE USED BEHIND CURBS (i.e. GRASS BOULEVARD).

NOTE: ALL DIMENSIONS ARE IN MILLIMETRES.

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKSTYPICAL 600 OR 700mm dia.  
CATCH BASIN

Drawn by: M.W.L.

Date: Dec. 02, 1996

Dwg. No. HS507.DWG

Approved by: M. Pertus  
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

## Division 8 Standard Drawings

FRAME, GRATING AND CURB  
SECTION-IMP #S361D OR EQUAL

DEPRESS 50

NORMAL GUTTER GRADE

CL ROAD GRADE

900 Ø PRECAST  
CONCRETE  
CATCH BASINLATERAL PIPE  
TO MANHOLE250 CONCRETE  
PIPE ASTM  
C14 CL.3 DR  
300 CONCRETE  
PIPE, ASTM  
C76 CL.111

J50 CRUSHED STONE

SECTION  
N.T.S.

NORMAL GRADE

NORMAL GRADE

PLAN  
N.T.S.

CURB

CATCH BASIN GRATING TO BE 2" LOWER THAN NORMAL GUTTER  
GRADE. SLOPE TO CATCH BASIN IS AS SHOWN.

CONCRETE

TOP OF CURB AT  
CL OF ROAD GRADEGUTTER GRATING  
DEPRESSED 50NORMAL CURB  
HEIGHTELEVATION - CURB AT CATCH BASIN  
N.T.S.DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## TYPICAL 900mm Ø CATCH BASIN

Drawn by: M.W.L.

Date: Dec. 02, 1996

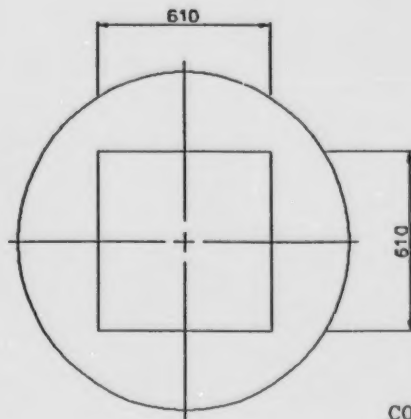
Dwg. No. HS508.DWG

Approved by: M. Pertus

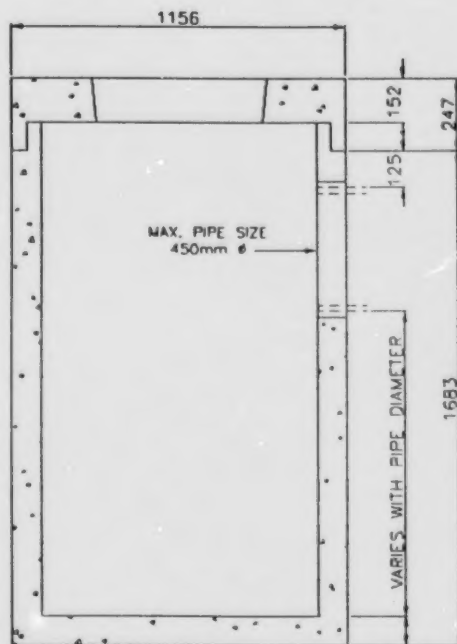
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

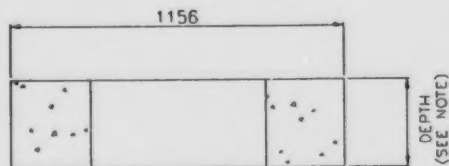
## Division 8 Standard Drawings



COVER PLAN



SECTION VIEW



GRADE RING DETAIL

## NOTES:

1. MINIMUM SUMP 450mm.
2. MAXIMUM 2 LEADS.
3. MAXIMUM LEAD SIZE 450mm.
4. NO INTERMEDIATE RINGS AVAILABLE.
5. GRADE RINGS AVAILABLE IN 150mm, 300mm, 400mm DEPTHS.
6. REQUIRED COVER S401 OR S361 OR EQUIVALENT.

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS.

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## TYPICAL 900mm dia. CATCH BASIN

Drawn by: M.W.L.

Date: Dec. 02, 1996

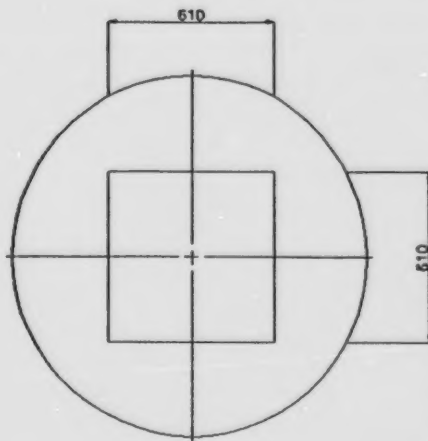
Dwg. No. HS509.DWG

Approved by: M. Perlus

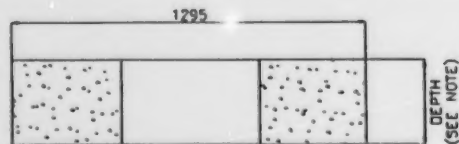
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

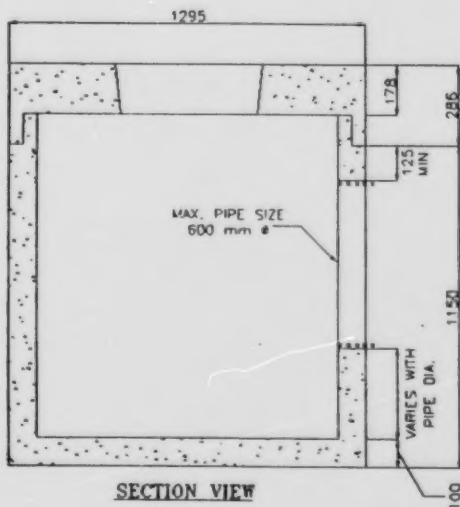
## Division 8 Standard Drawings



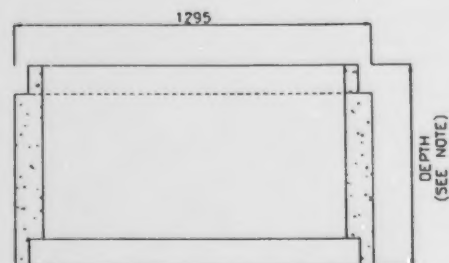
COVER PLAN



GRADE RING DETAIL



SECTION VIEW



INTERMEDIATE RING DETAIL

## NOTE

- 1 MINIMUM SUMP 450 mm
- 2 MAXIMUM 3 LEADS (2-600 mm dia., 1-300 mm dia.)
- 3 INTERMEDIATE RINGS AVAILABLE IN 500 mm, 750 mm, 1000 mm, 1250 mm DEPTHS.
- 4 GRADE RINGS AVAILABLE IN 150 mm, 300 mm, 400 mm DEPTHS
- 5 REQUIRED COVERS S401 OR S361 OR EQUIVALENT.
- 6 OPTIONAL COVERS AVAILABLE CPC 175D (DUPLEX COVER) OR CPC 450 (50,000 kg LOADING).

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## TYPICAL 1050mm dia. CATCH BASIN

Drawn by: M.W.L.

Date: Dec. 02, 1996

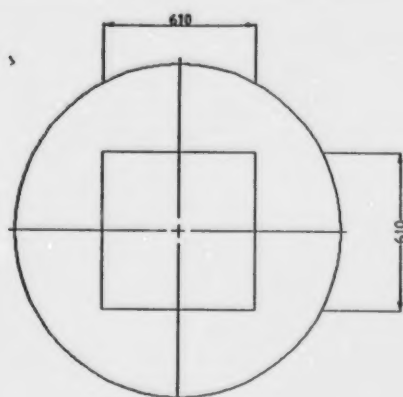
Dwg. No. HS510.DWG

Approved by: M. Pertus

Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

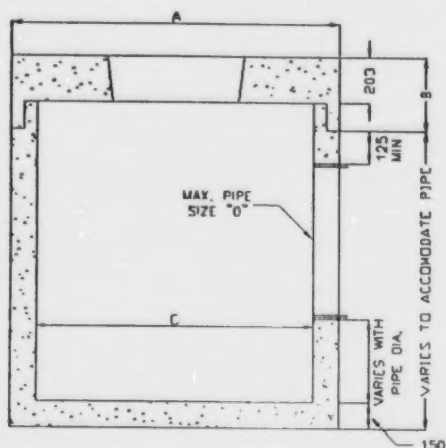




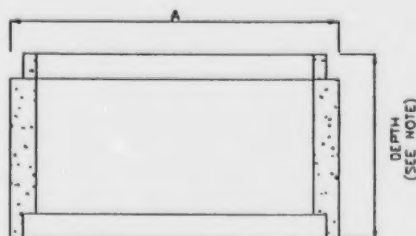
COVER PLAN



GRADE RING DETAIL



SECTION VIEW



INTERMEDIATE RING DETAIL

CATCH BASIN - TABLE OF SIZES - METRIC (mm)

| BASE SECTION |                  |      |      |        | TOP SECTION      |      |     |
|--------------|------------------|------|------|--------|------------------|------|-----|
| SIZE         | UNIT DESIGNATION | A    | B    | C      | UNIT DESIGNATION | A    | B   |
| 1200 mm      | EPB----          | 1473 | 1219 | 750 #  | EPC 200          | 1473 | 286 |
| 1500 mm      | KPB----          | 1828 | 1524 | 900 #  | KPC 200          | 1828 | 324 |
| 1800 mm      | LPB----          | 2222 | 1828 | 1200 # | LPC 200          | 2222 | 336 |
| 2100 mm      | RPB----          | 2578 | 2134 | 1500 # | RPC 200          | 2578 | 330 |
| 2400 mm      | OPB----          | 2934 | 2438 | 1800 # | OPC 200          | 2934 | 336 |

NOTE

- 1 MINIMUM SUMP 450 mm
- 2 MAXIMUM 3 LEADS (2-600 mm dia., 1-300 mm dia.)
- 3 INTERMEDIATE RINGS AVAILABLE IN 500 mm, 750 mm, 1000 mm, 1250 mm DEPTHS.
- 4 GRADE RINGS AVAILABLE IN 150 mm, 300 mm, 400 mm DEPTHS
- 5 REQUIRED COVERS S401 OR S361 OR EQUIVALENT.
- 6 OPTIONAL COVERS AVAILABLE CPC 1750 (DUPEX COVER) OR CPC 450 (50,000 kg LOADING).

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS



DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

TYPICAL 1200 - 2400mm dia.  
CATCH BASIN

Drawn by: M.W.L.

Date: Dec. 02, 1996

Dwg. No. HS511.DWG

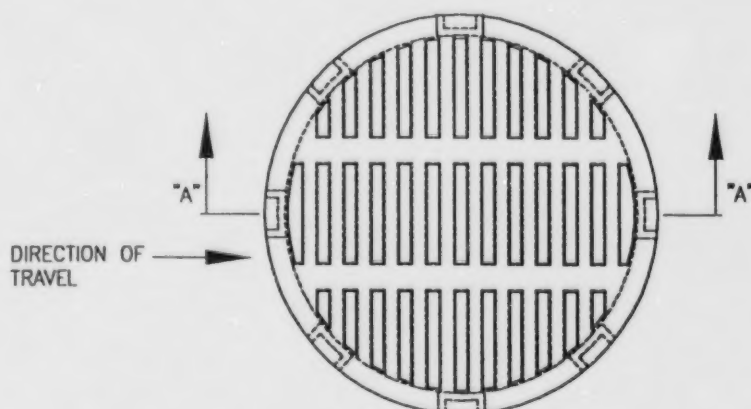
Approved by: M. Pertus

Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

A plan view of a circular structure, likely a well or a small tunnel. The interior is filled with a grid of vertical and horizontal lines, representing a mesh or reinforcement. Four arrows point outwards from the perimeter, labeled 'B', indicating the direction of observation or measurement.

SECTION "B-B"



1 GRATING PLACED SO THAT SLOTS IN THE GRATING ARE AT RIGHT ANGLES TO THE DIRECTION OF TRAVEL.



DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

Drawn by: M.W.L.

Date: Dec. 02, 1998

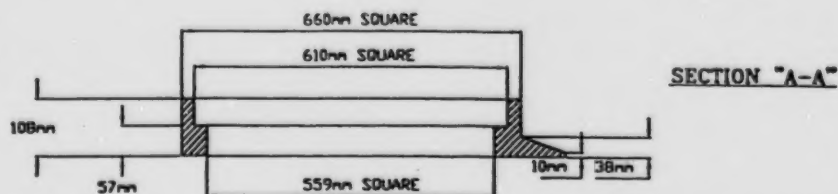
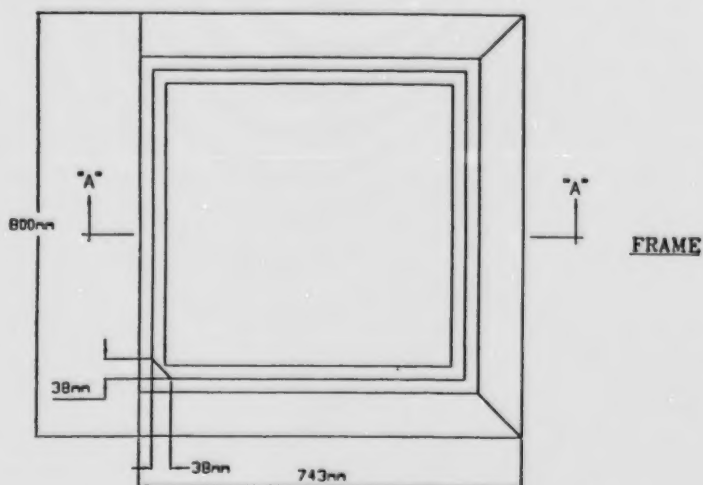
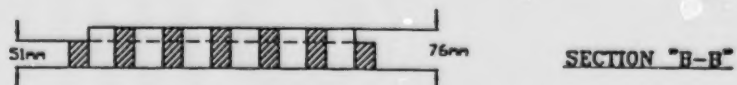
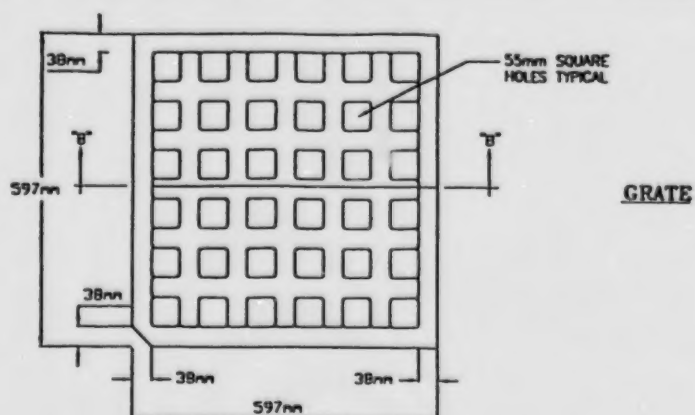
Dwg.No. HSS12.DWG

Approved by: M. Pertus

**Title:** Manager, Highway  
and Bridge Design

Date: Dec.16,1996

## Division 8 Standard Drawings



NOTE: ALL DIMENSIONS ARE IN MILLIMETRES

## NOTES:

1. USE S400/S410 FRAME AND COVER FOR MANHOLES.
2. S401 GRATE IS SAME SIZE AS S400/S410 COVER.

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## S 401 FRAME AND GRATE

Drawn by: M.W.L.

Date: Dec. 02, 1996

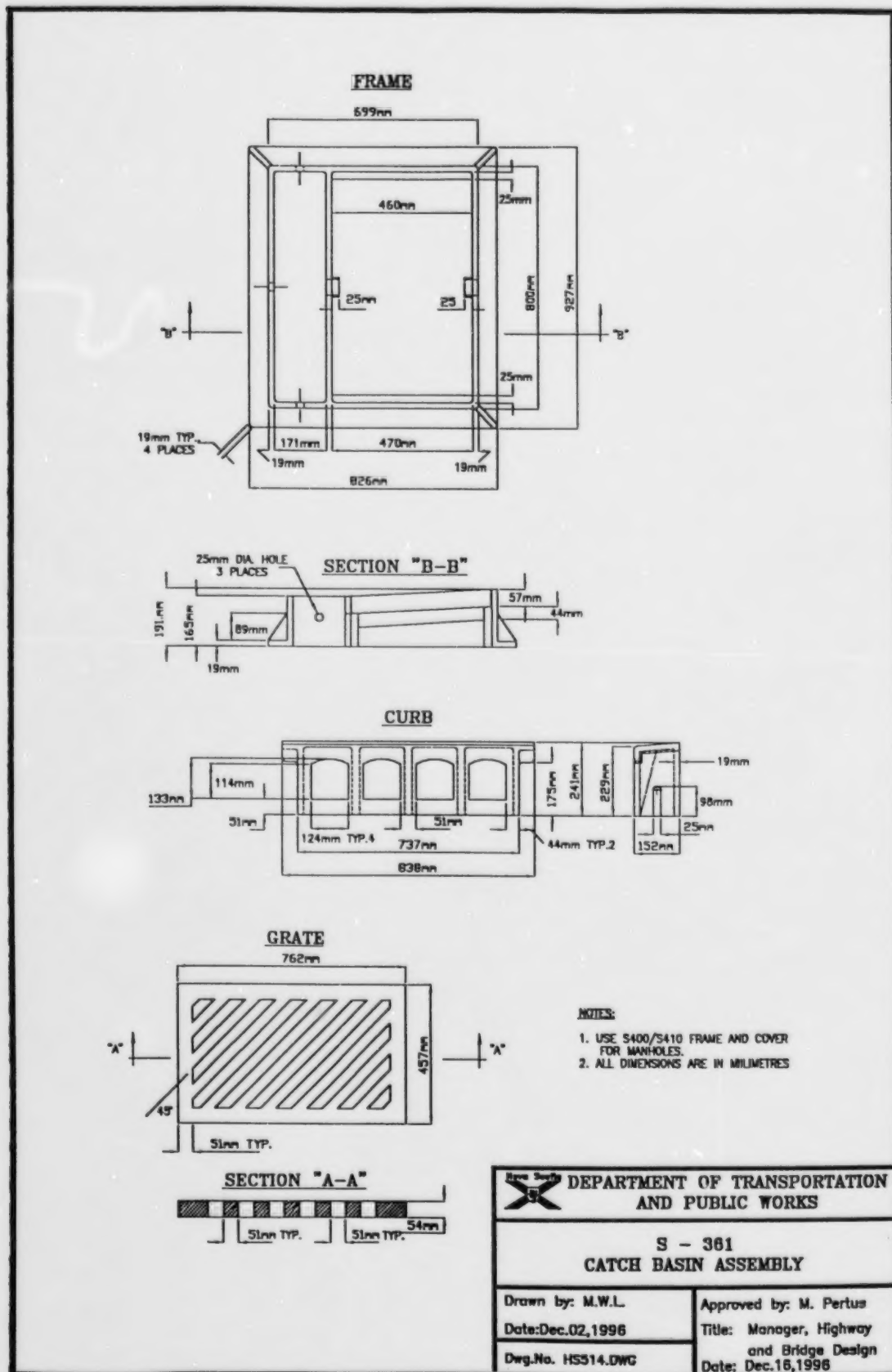
Dwg. No. HS513.DWG

Approved by: M. Pertus

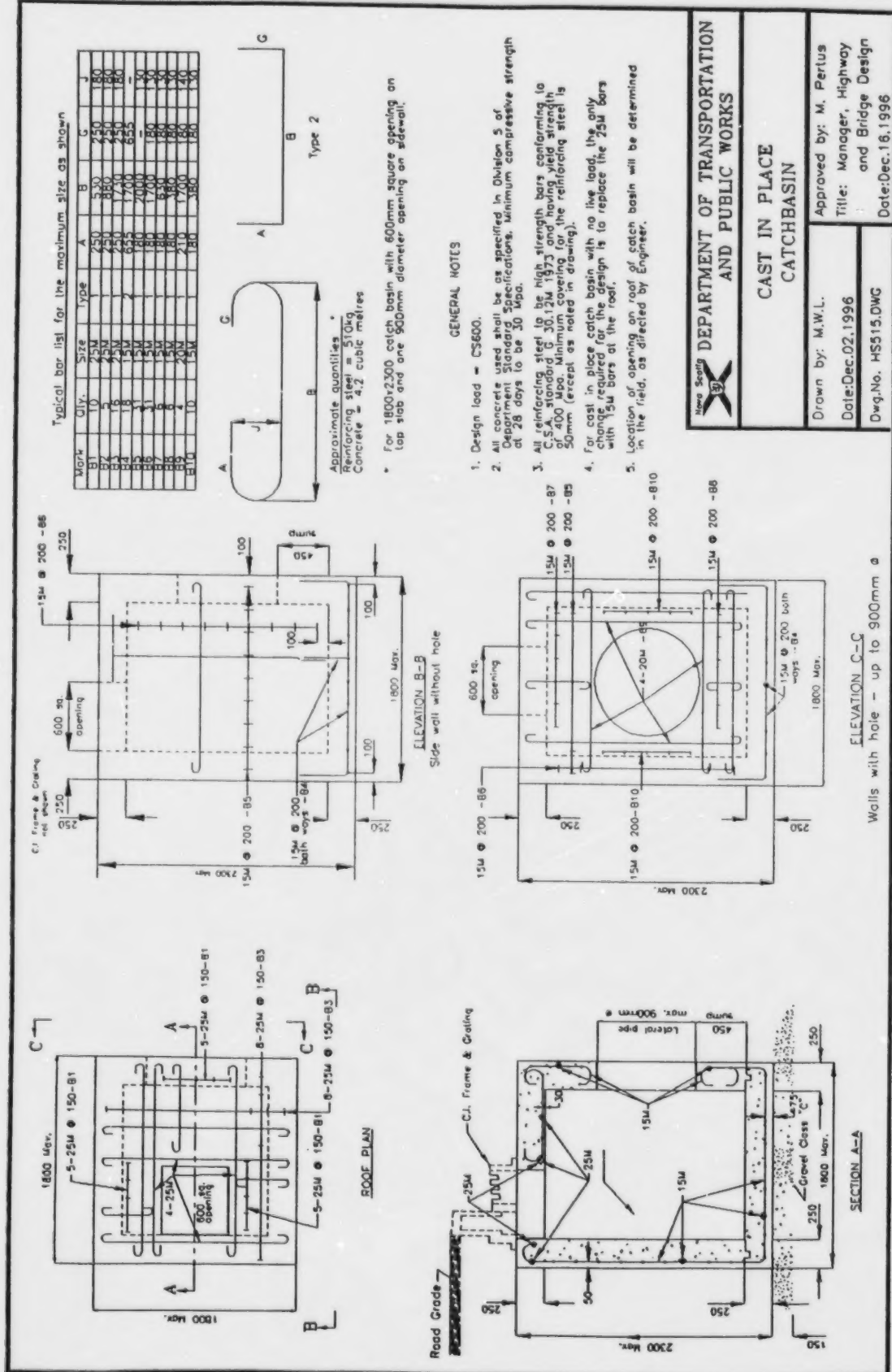
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

## Division 8 Standard Drawings

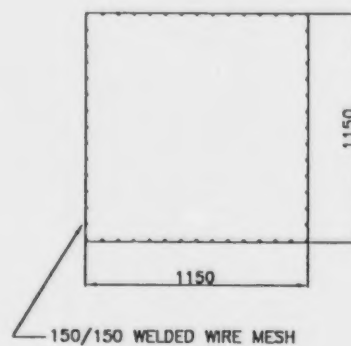
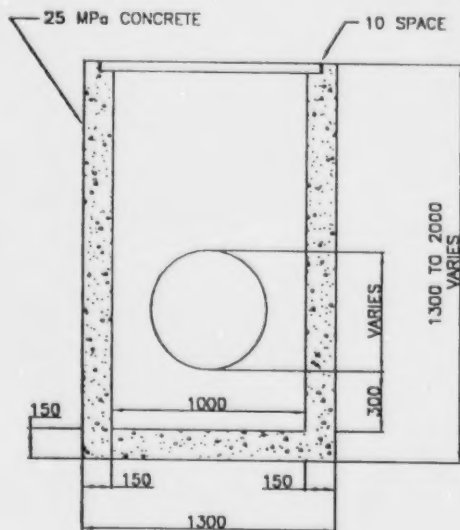
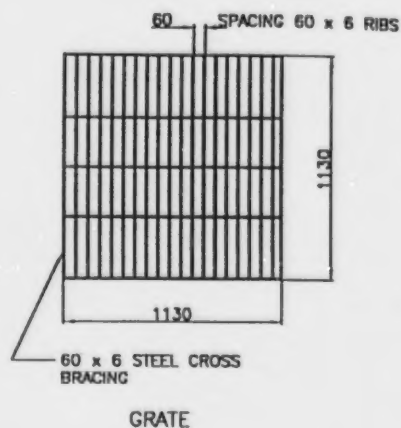
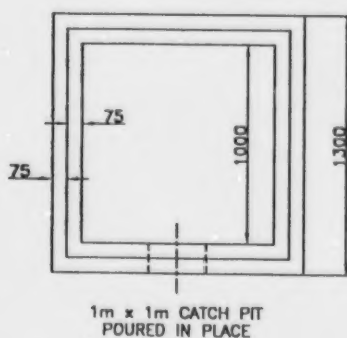


## Division 8 Standard Drawings





## Division 8 Standard Drawings



NOTE: ALL DIMENSIONS ARE IN MILLIMETRES

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## CATCH BASIN FOR MEDIAN

Drawn by: M.W.L.

Date: Dec. 02, 1996

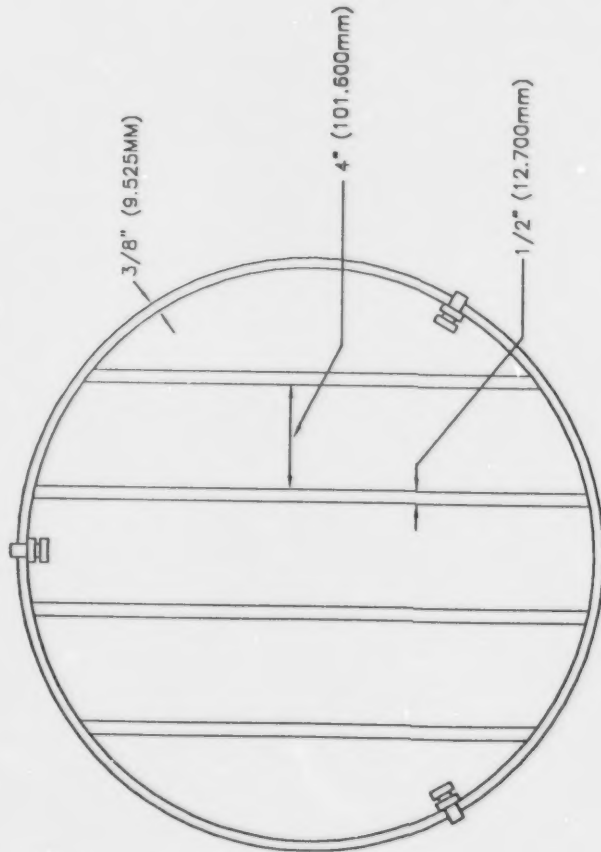
Dwg. No. HS516.DWG

Approved by: M. Pertus

Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

## Division 8 Standard Drawings

PIPE GRATES

NOTE: ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

 DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

PIPE GRATES

Drawn by: M.W.L.

Date: Dec. 02, 1996

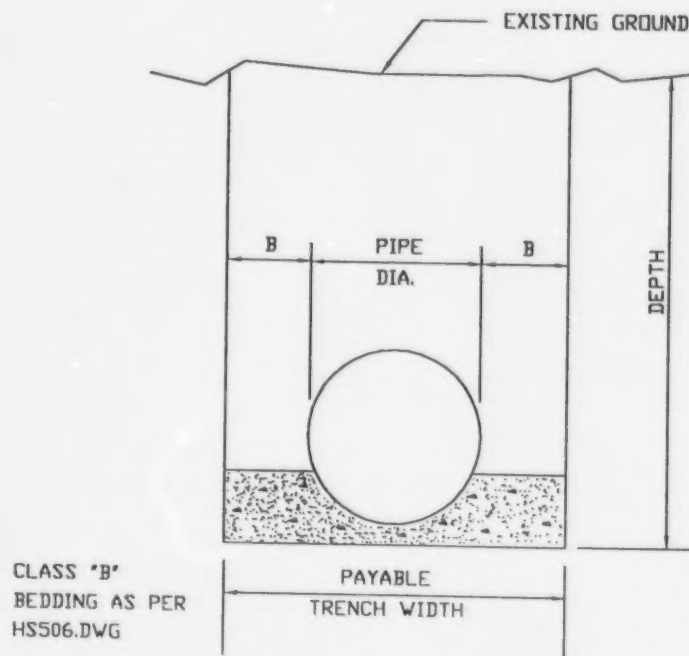
Dwg. No. HSS17.DWG

M. Pertus

Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

## Division 8 Standard Drawings



| PIPE<br>SIZE, mm | DIMENSION<br>B            |
|------------------|---------------------------|
| UP TO 375        | 300                       |
| 376 TO 500       | 300                       |
| 501 TO 750       | 400                       |
| 751 TO 1200      | 400                       |
| OVER 1200        | SEE SPECIAL<br>PROVISIONS |



DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

STORM SEWER EXCAVATION LIMITS

Drawn by: M.W.L.

Date: Dec. 02, 1996

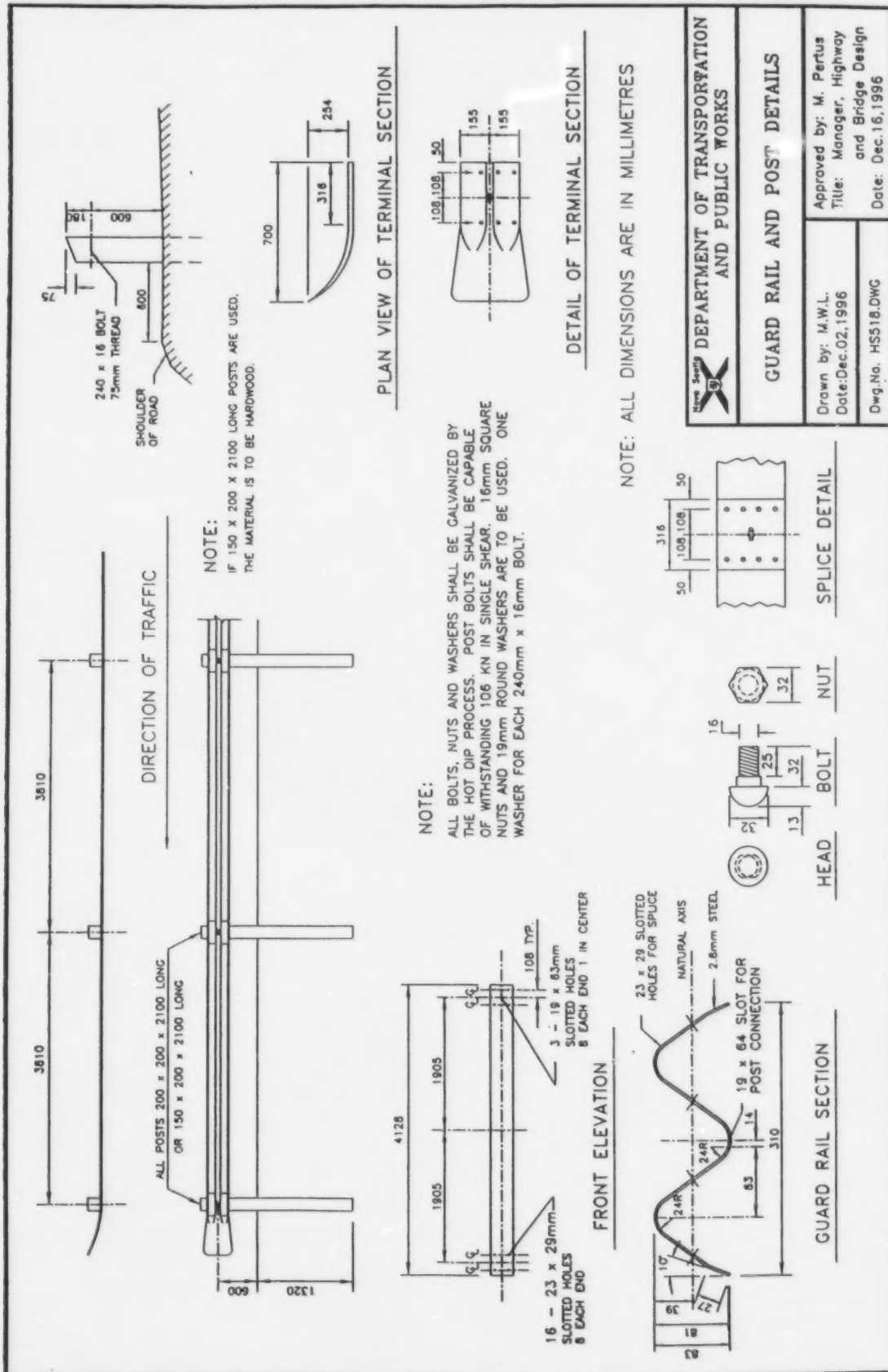
Dwg. No. HS528.DWG

Approved by: M. Pertus

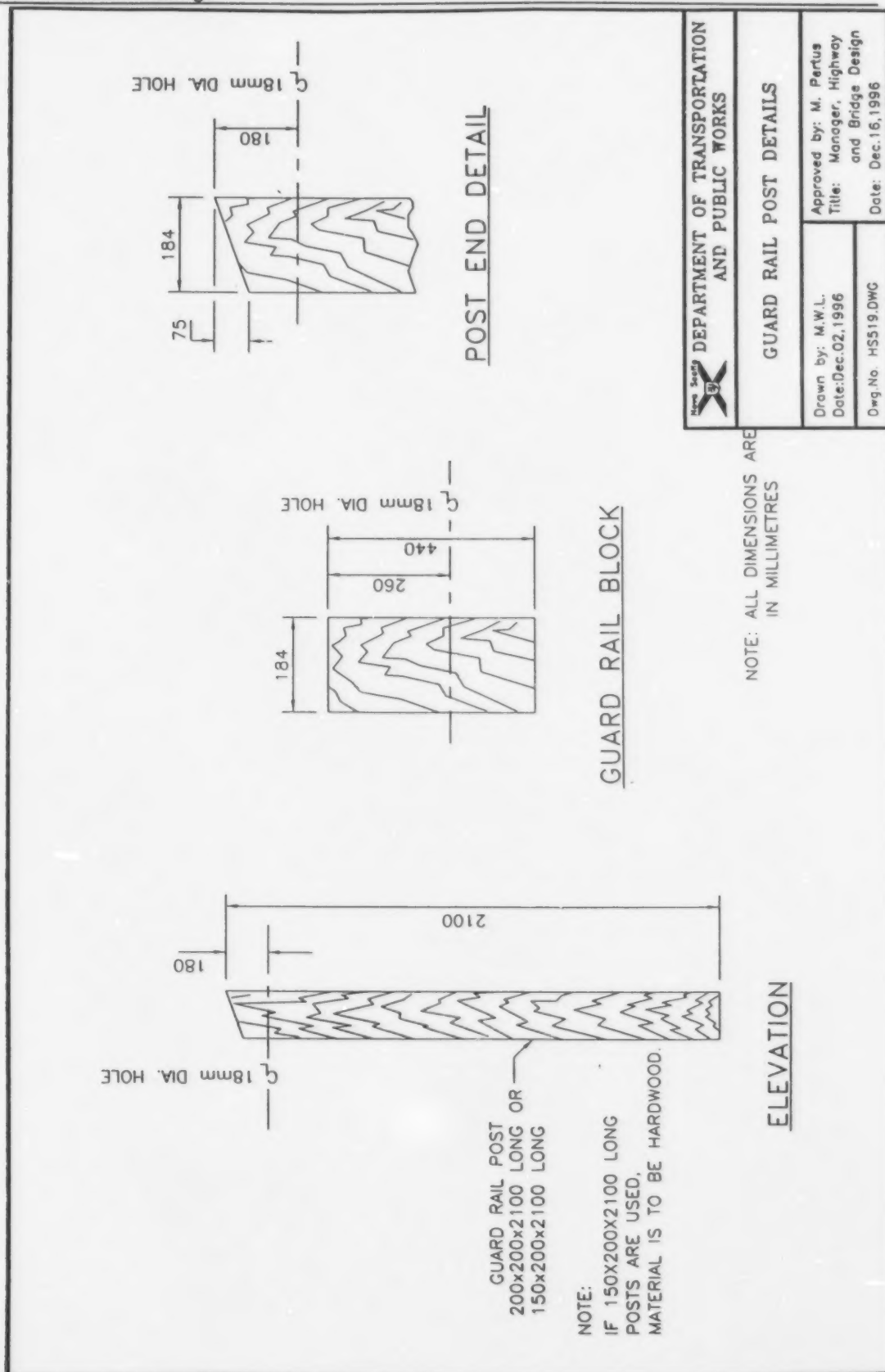
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

## Division 8 Standard Drawings



## Division 8 Standard Drawings



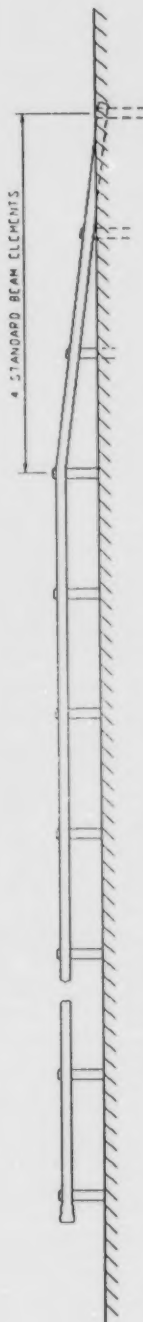


## Division 8 Standard Drawings

| POST OFFSET TABLE |      |  |
|-------------------|------|--|
| FILL OR CUT       |      |  |
| X                 | Y    |  |
| 3.81              | 0.04 |  |
| 7.62              | 0.15 |  |
| 11.42             | 0.34 |  |
| 15.22             | 0.60 |  |
| 19.02             | 0.94 |  |
| 22.81             | 1.35 |  |



PLAN - FILL OR CUT



ELEVATION

NOTE: ALL DIMENSIONS ARE IN METRES

## NOTES:

1. ALL LATERAL DIMENSIONS MEASURED FROM FACE OF RAIL.
2. GUARD RAIL MAY BE PLACED AS PRACTICABLE FROM EDGE OF SHOULDER. IN NO CASE MAY GUARD RAIL BE PLACED DOWN THE SLOPE.

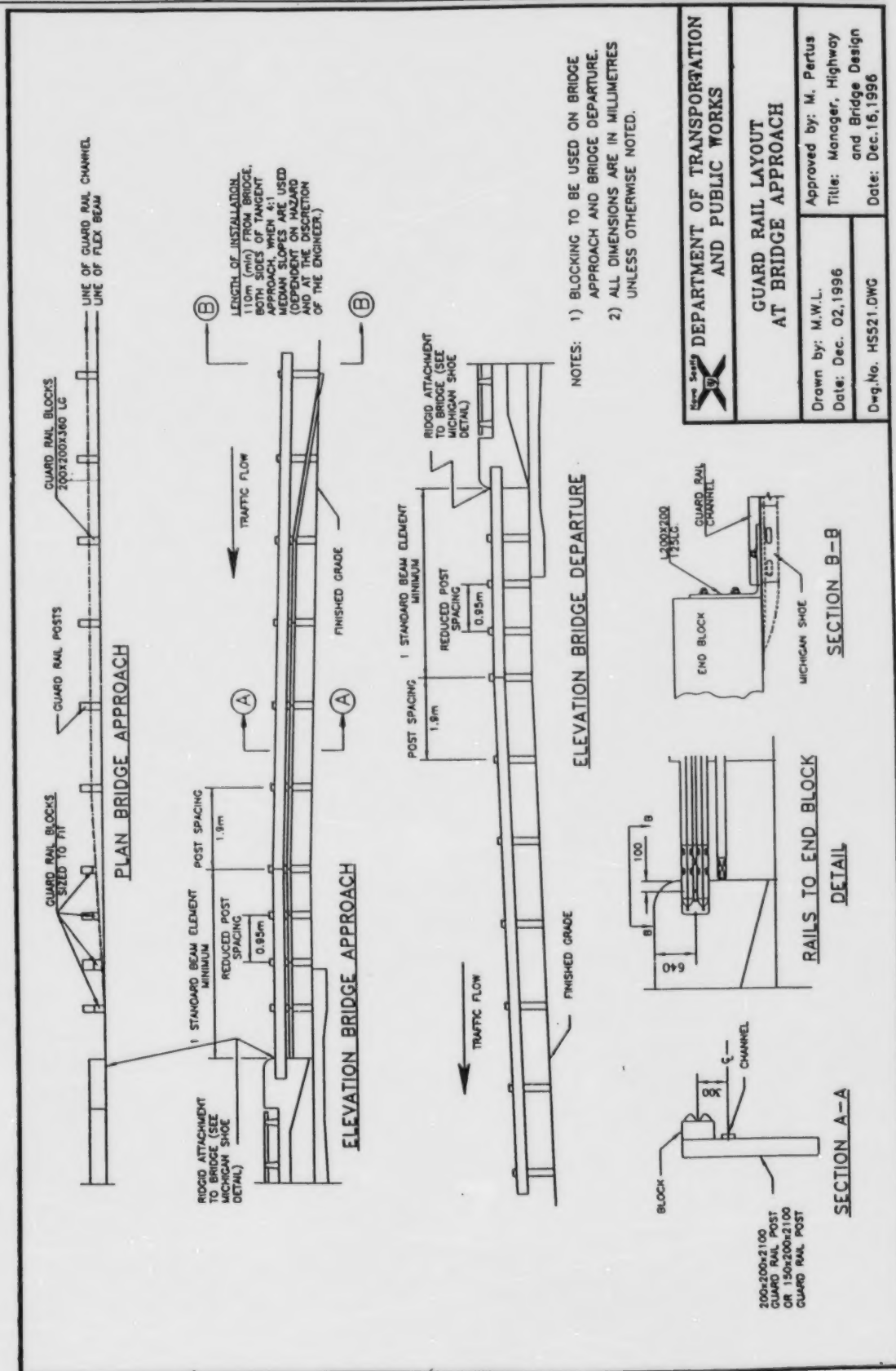
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

STEEL BEAM GUARD RAIL INSTALLATION DETAIL  
SINGLE RAIL END TREATMENT

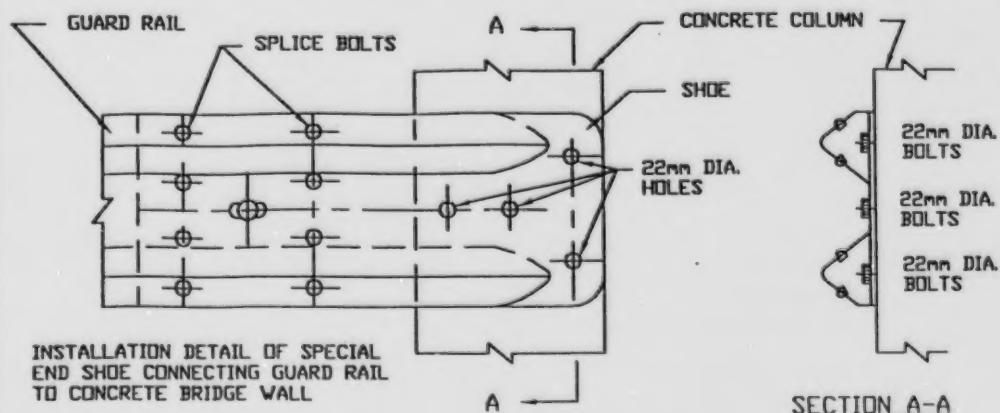
Drawn by: M.W.L.  
Title: Manager, Highway  
Date: Dec.02, 1996  
Dwg.No. HS520.DWG

Approved by: M. Pertus  
Title: Manager, Highway  
and Bridge Design  
Date: Dec.16, 1996

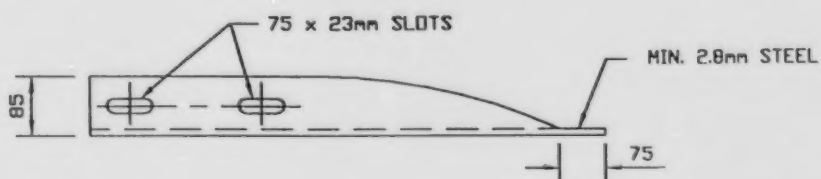
## Division 8 Standard Drawings



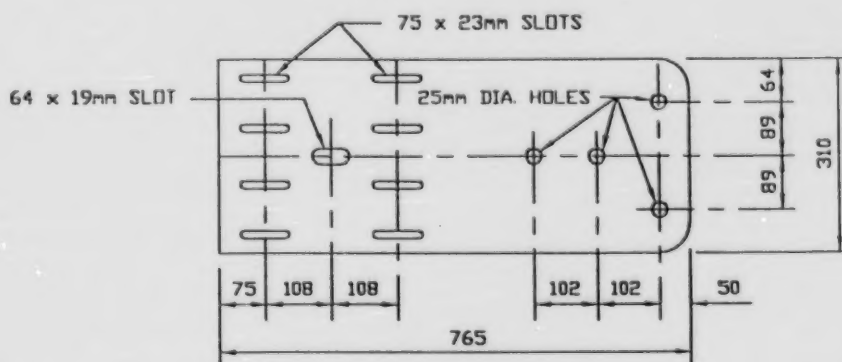
## Division 8 Standard Drawings



## ELEVATION DETAIL OF INSTALLED SHOE



## PLAN DETAIL OF SHOE



## ELEVATION DETAIL OF SHOE

NOTE: ALL DIMENSIONS ARE  
IN MILLIMETRES



DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## MICHIGAN SHOE DETAILS

Drawn by: M.W.L.

Date: Dec. 02, 1996

Dwg. No. HS322.DWC

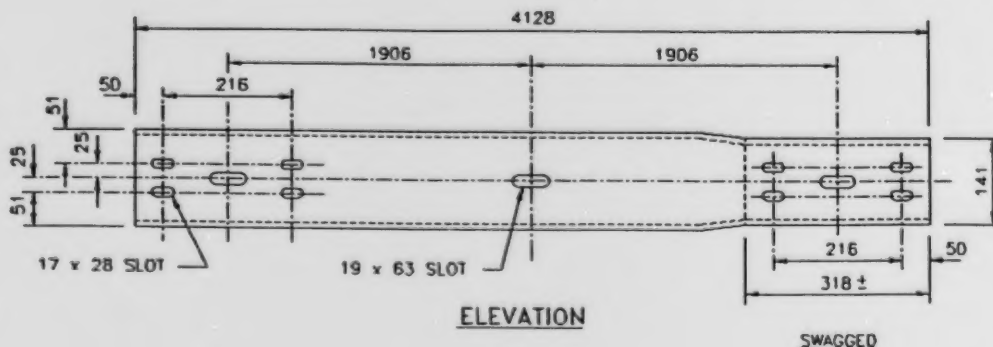
Approved by: M. Pertus

Title: Manager, Highway  
and Bridge Design  
Date: Dec. 16, 1996

## Division 8 Standard Drawings



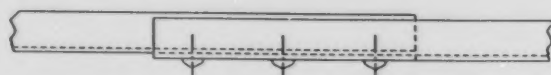
PLAN VIEW



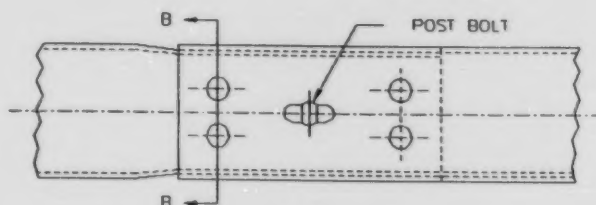
ELEVATION

SWAGGED

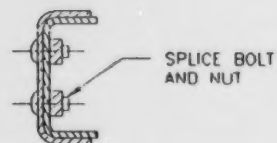
## COLD ROLLED CHANNEL DETAIL



PLAN VIEW



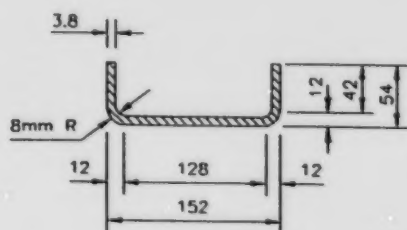
ELEVATION



SECTION B-B

SPICE BOLT  
AND NUT

## SWAGGED SPLICE DETAIL



SECTION D-D

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## GUARD RAIL CHANNEL DETAILS

Drawn by: M.W.L.

Date: Dec.02,1996

Dwg.No. HS5230WG

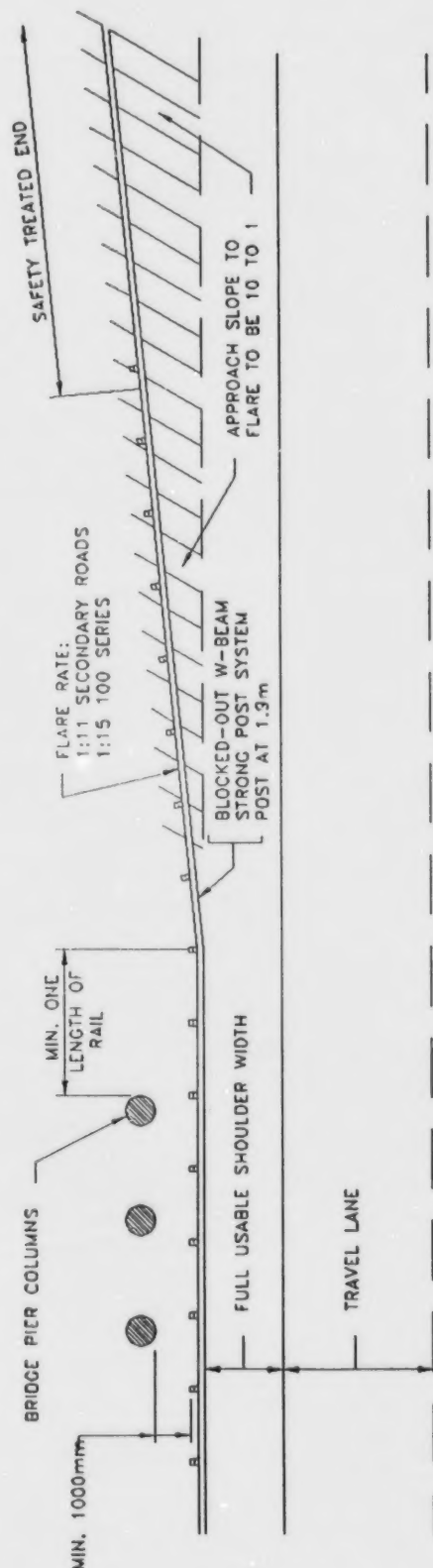
Approved by: M. Pertus

Title: Manager, Highway

and Bridge Design

Date: Dec.16,1996

## Division 8 Standard Drawings



 DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

### GUARD RAIL PROTECTION OF BRIDGE PIERS

Drawn by: M.W.L.

Date: Dec.02,1996

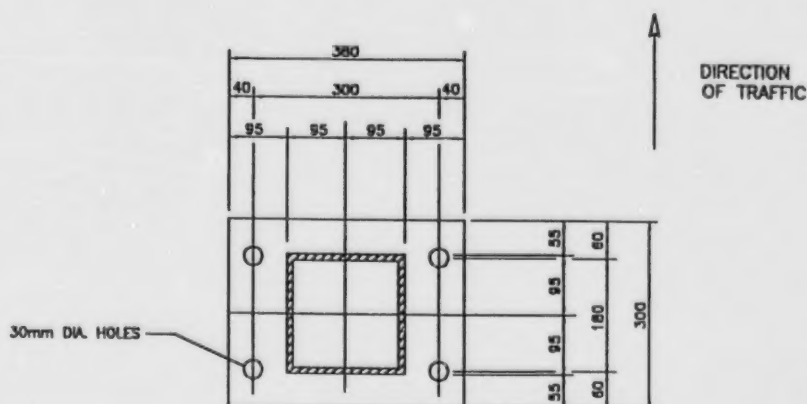
Approved by: M. Perlus  
Title: Manager, Highway  
and Bridge Design

Date: Dec.16,1996

Dwg.No. HS524.DWG

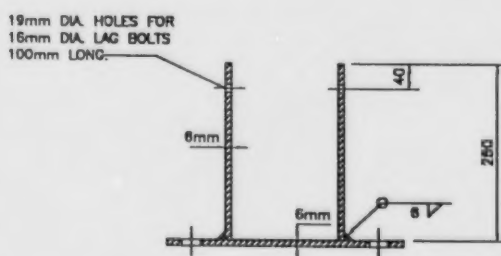


## Division 8 Standard Drawings



PLAN OF BASE

SCALE: 1 : 10



SECTION OF BASE

SCALE: 1 : 10

BASE PLATE IS HELD IN PLACE BY WEDGE ANCHORS (RED HEAD PHILLIPS ANCHORS WS-7860 OR EQUIVALENT) INSTALLED TO MANUFACTURER'S SPECIFICATIONS. ANCHORS ARE 22mm DIA. x 150mm LONG WITH 100mm EMBEDMENT.



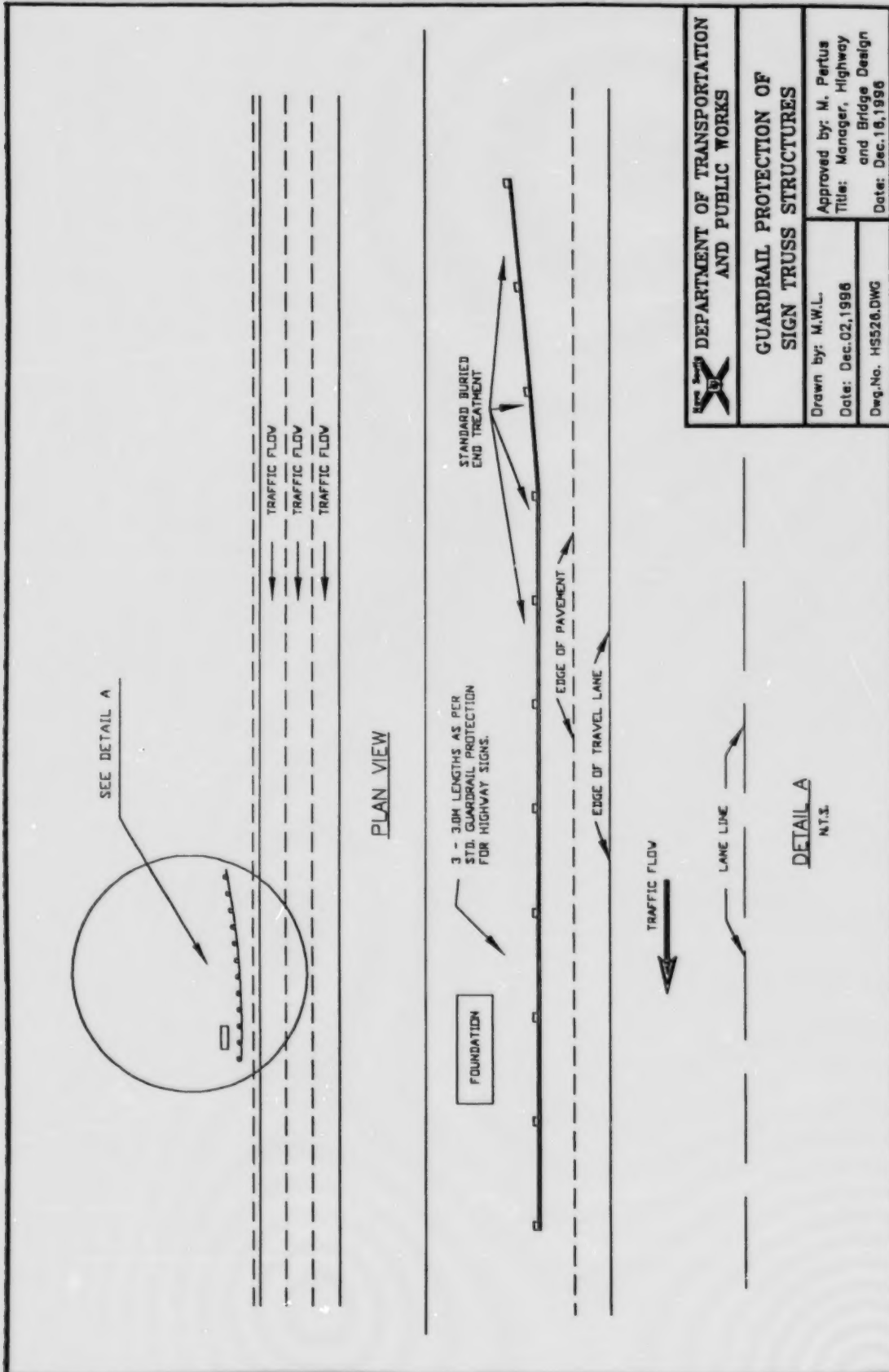
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

GUARDRAIL ANCHOR BASE  
ON CONCRETE

Drawn by: M.W.L.  
Date: Dec.02,1996  
Dwg.No. HSS25.DWG

Approved by: M. Pertus  
Title: Manager, Highway  
and Bridge Design  
Date: Dec.16,1996

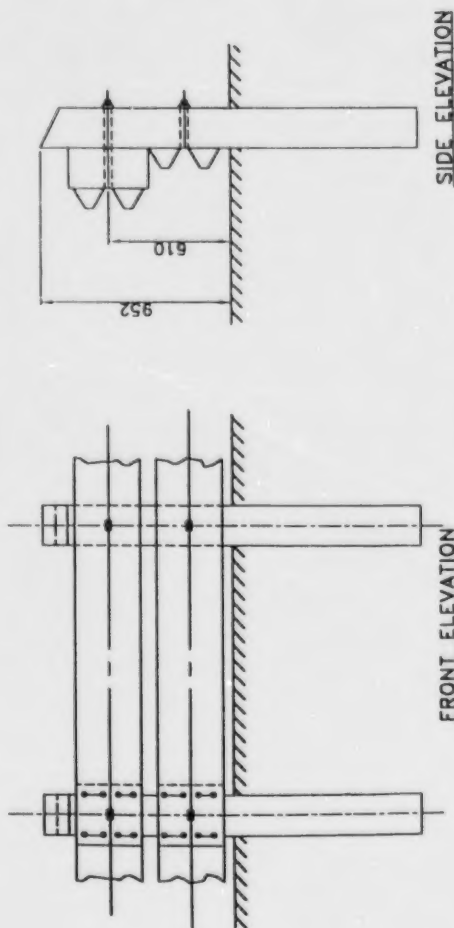
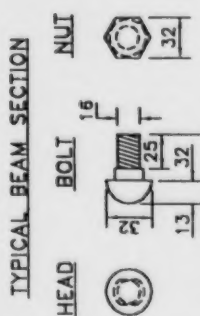
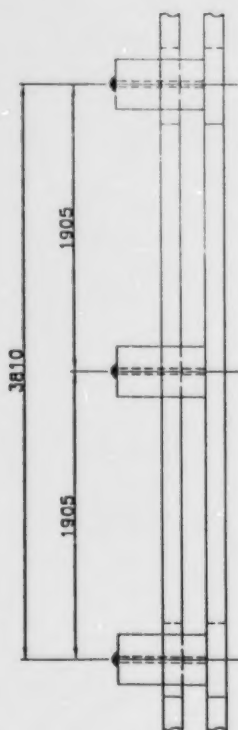
Division 8 Standard Drawings



## Division 8 Standard Drawings

## NOTE:

ALL BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED BY THE HOT DIP PROCESS. POST BOLTS SHALL BE CAPABLE OF WITHSTANDING 106 KN IN SINGLE SHEAR. 16mm SQUARE NUTS AND 19mm ROUND WASHERS ARE TO BE USED. ONE WASHER FOR EACH 240mm x 16mm BOLT.



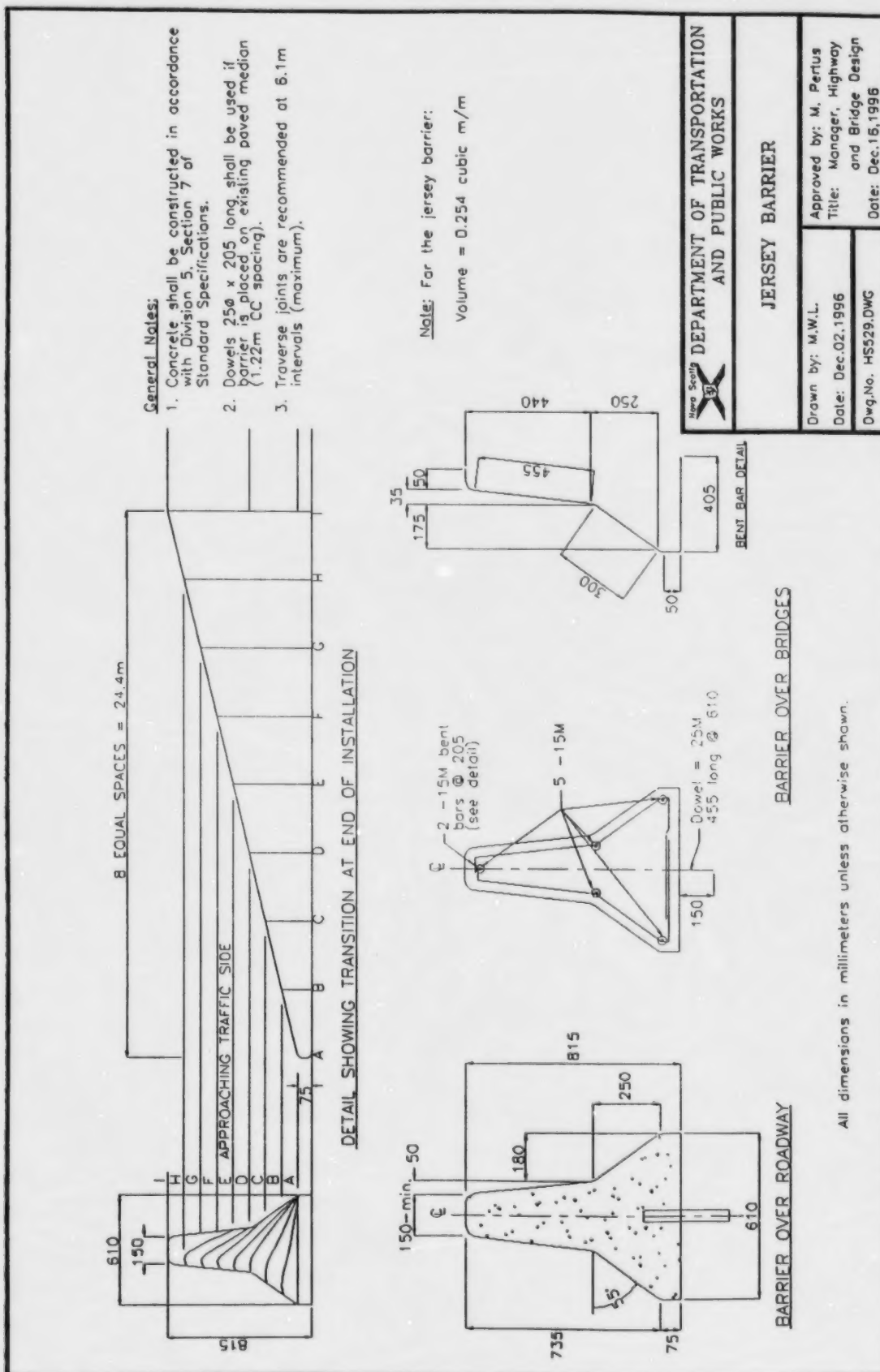
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

GUARDRAIL PROTECTION  
OF HIGHWAY SIGNS

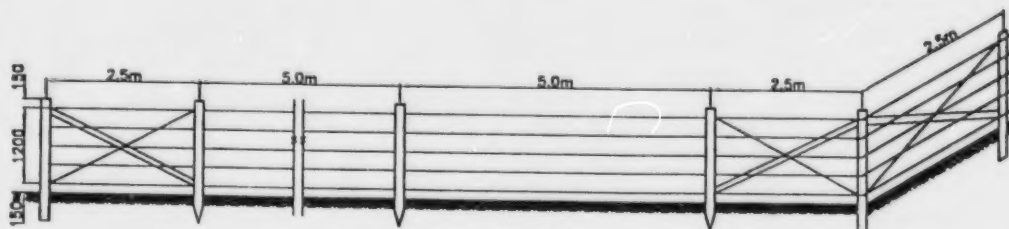
|                   |                                           |
|-------------------|-------------------------------------------|
| Drawn by: M.W.L.  | Approved by: M. Pertus                    |
| Date: Dec.02,1996 | Title: Manager, Highway and Bridge Design |
| Dwg.No. HS527.DWG | Date: Dec.16,1996                         |

NOTE: ALL DIMENSIONS ARE IN MILLIMETRES

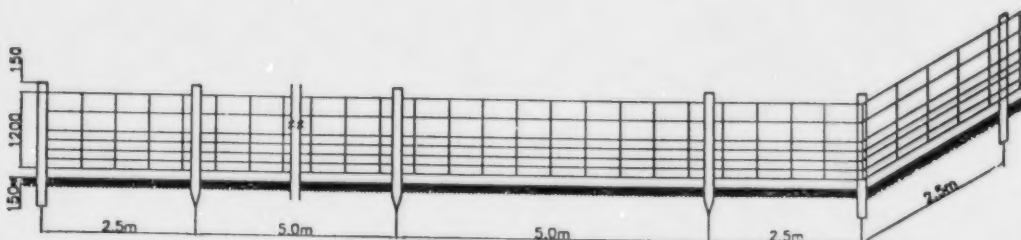
## Division 8 Standard Drawings



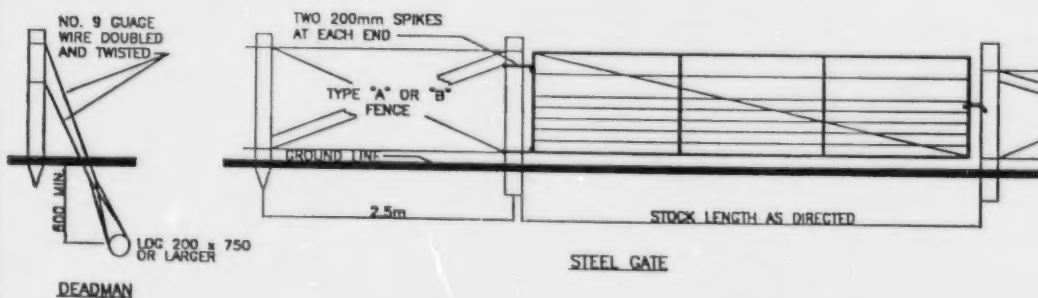
THE SPACING OF POSTS AT ENDS, CORNERS AND GATES SHALL NOT BE MORE THAN 2.5m. ALL OTHER POSTS SHALL BE SPACED NOT MORE THAN 5.0m APART. WIRES SHALL BE STRETCHED TAUT AND FASTENED SECURELY TO POSTS AS DIRECTED BY THE ENGINEER WITH APPROVED 40mm GALVANIZED STAPLES. END, CORNER AND GATE POSTS SHALL BE FIRMLY BRACED WITH DIAGONALS EXTENDING FROM A POINT ON THE POST AT THE ELEVATION OF THE TOP FENCE WIRE TO A POINT ABOUT 150mm ABOVE THE GROUND LEVEL ON THE ADJACENT POST. POSTS SHALL BE SLIGHTLY FLATTENED AT JUNCTION WITH BRACE. MINIMUM CROSS SECTION OF BRACES 125mm DIAMETER OR 100mm SQUARE. DOUBLE STAY WIRES NO. 9 GAUGE (PLAIN) SHALL BE STRETCHED FROM A POINT ABOUT 150mm ABOVE THE GROUND LEVEL ON END, GATE AND CORNER POSTS TO A POINT ON THE ADJACENT POST AT THE ELEVATION OF THE TOP FENCE WIRE. STAY WIRES SHALL BE FASTENED SECURELY TO EACH POST WITH 40mm GALVANIZED STAPLES AND TWISTED TOGETHER TAUT.



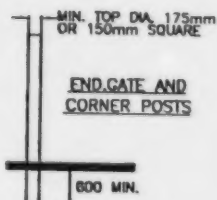
TYPE "A" FENCE - UNWOVEN  
FIVE STRAND GALVANIZED WIRE



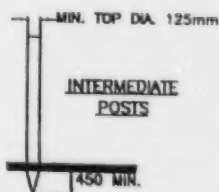
TYPE "B" FENCE - WOVEN MESH  
SEVEN STRAND GALVANIZED WIRE



ALL DIMENSIONS ARE IN MILLIMETRES  
EXCEPT WHERE NOTED



### END GATE AND CORNER POSTS



### INTERMEDIATE POSTS

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

### RIGHT-OF-WAY WIRE FENCE

Approved by: M. Pertus  
Title: Manager, Highway  
and Bridge Design

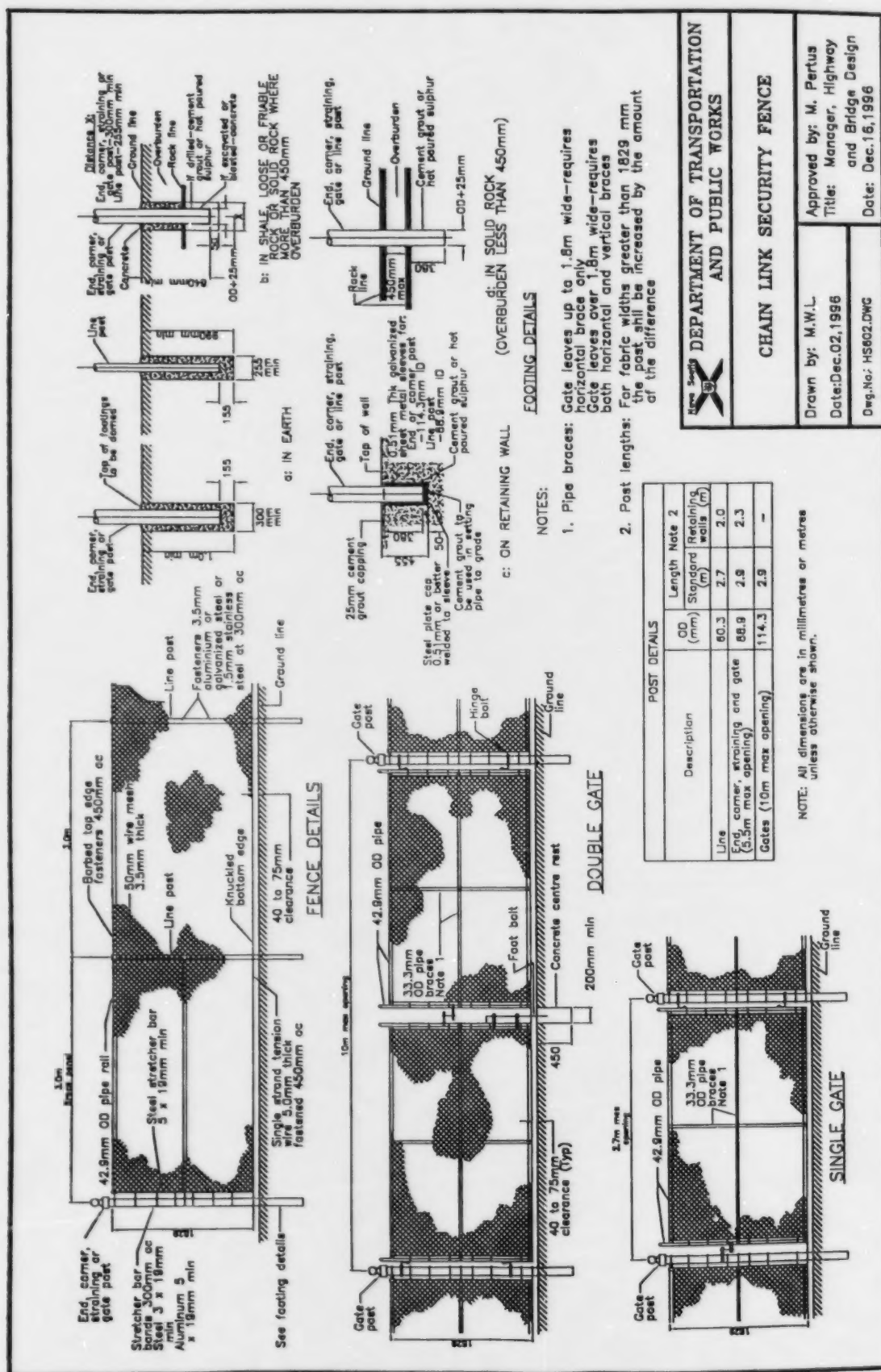
Date: Dec. 16, 1996

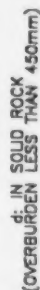
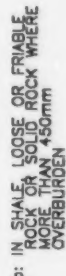
Dwg.No. HS001.DWG

Date: Dec. 16, 1996



## Division 8 Standard Drawings





## FOOTING DETAILS



| POST DETAILS                                       |         |              |                     |
|----------------------------------------------------|---------|--------------|---------------------|
| Description                                        | OD (mm) | Length       |                     |
|                                                    |         | Standard (m) | Retaining walls (m) |
| Line                                               | 60.3    | 2.7          | 2.0                 |
| End, corner, straining and gate (3.5m max opening) | 88.9    | 2.9          | 2.3                 |
| Gates (10m max opening)                            | 114.3   | 2.9          | -                   |

NOTE: All dimensions are in millimetres or metres unless otherwise shown.


 DEPARTMENT OF TRANSPORTATION  
 AND PUBLIC WORKS

## CHAIN LINK FENCE FOR ROADWAY INSTALLATIONS

Drawn by: M.W.L

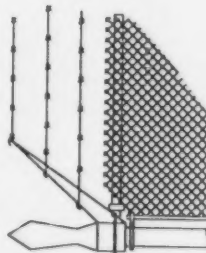
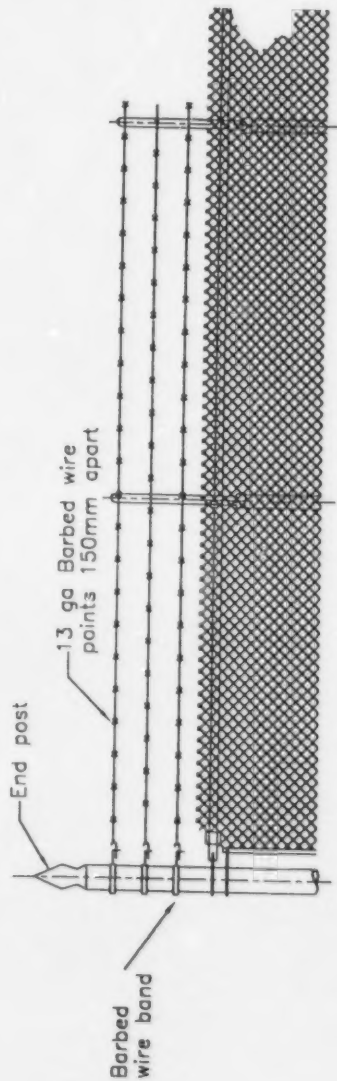
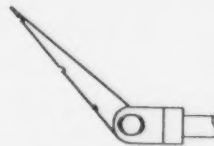
Approved by: M. Pertus

**Title:** Manager, Highway

Dwg.No. HS603.DWG

Date: Dec. 16, 1996

## Division 8 Standard Drawings

CORNER POST  
WITH BARBED WIRE ARM

BARBED WIRE ARM

## NOTE:

All dimensions are in millimetres or metres unless otherwise shown.


 DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS
INSTALLATION OF BARBED WIRE  
FOR CHAIN LINK FENCES

Drawn by: M.W.L.

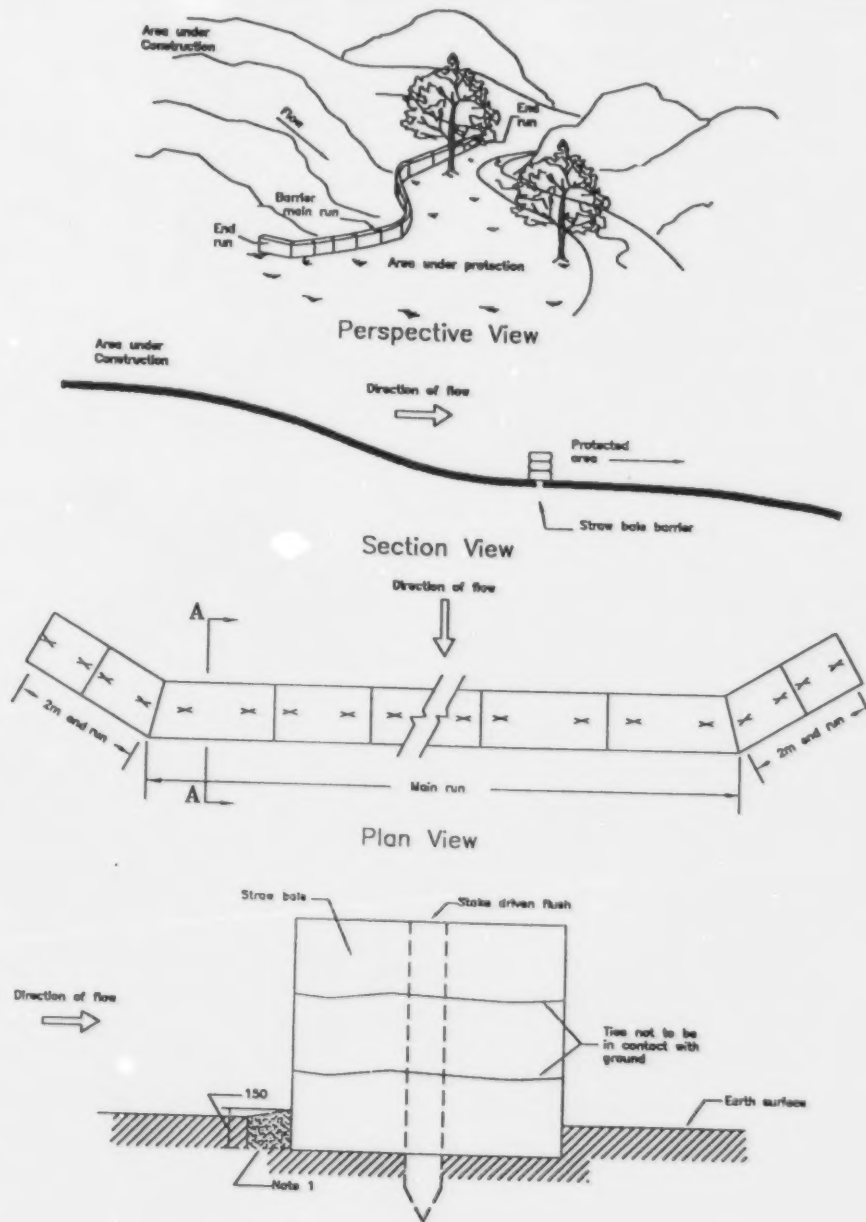
Date: Dec. 02, 1996

Dwg. No. HS604.DWG

Approved by: M. Pertus  
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

## Division 8 Standard Drawings



SECTION A-A

## NOTES:

- 1 Balance of excavated trench to be backfilled following bale placement.
- 2 All dimensions are in millimetres or metres unless otherwise noted.

DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## STRAW BALE BARRIER

Drawn by: M.W.L.

Date: Dec. 02, 1996

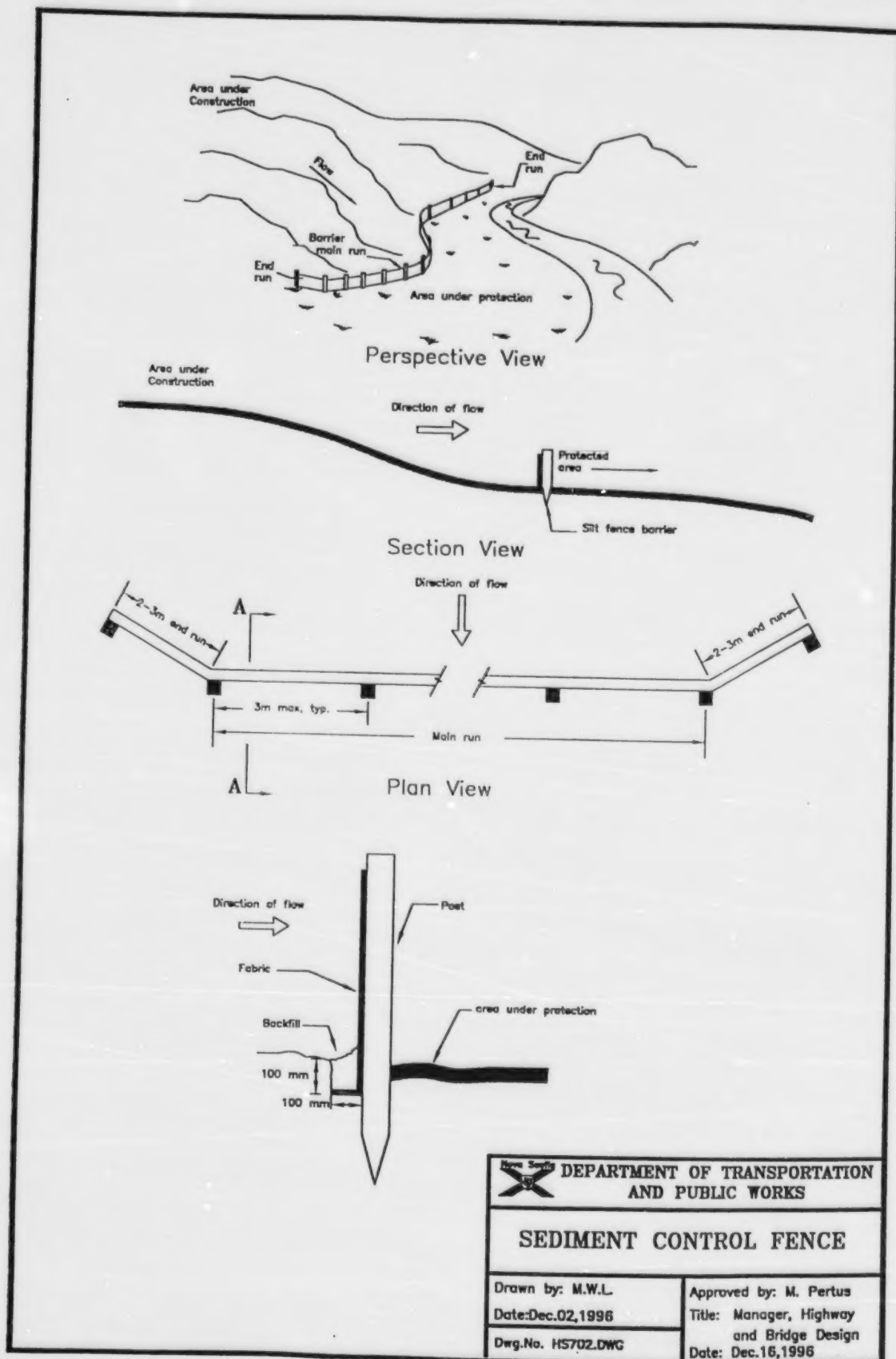
Dwg. No. HS701.DWG

Approved by: M. Pertus

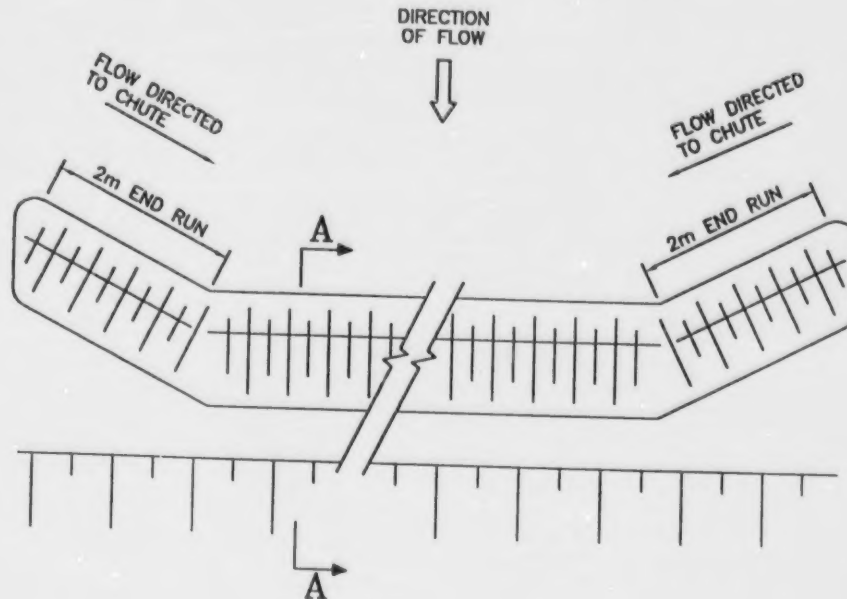
Title: Manager, Highway  
and Bridge Design

Date: Dec. 16, 1996

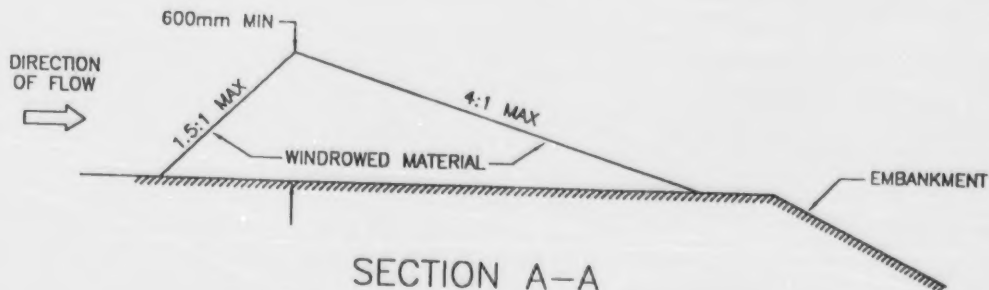
## Division 8 Standard Drawings







PLAN VIEW



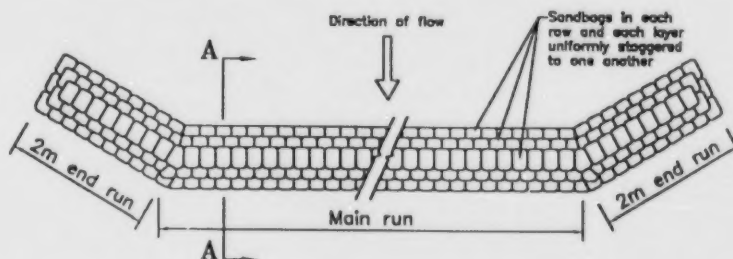
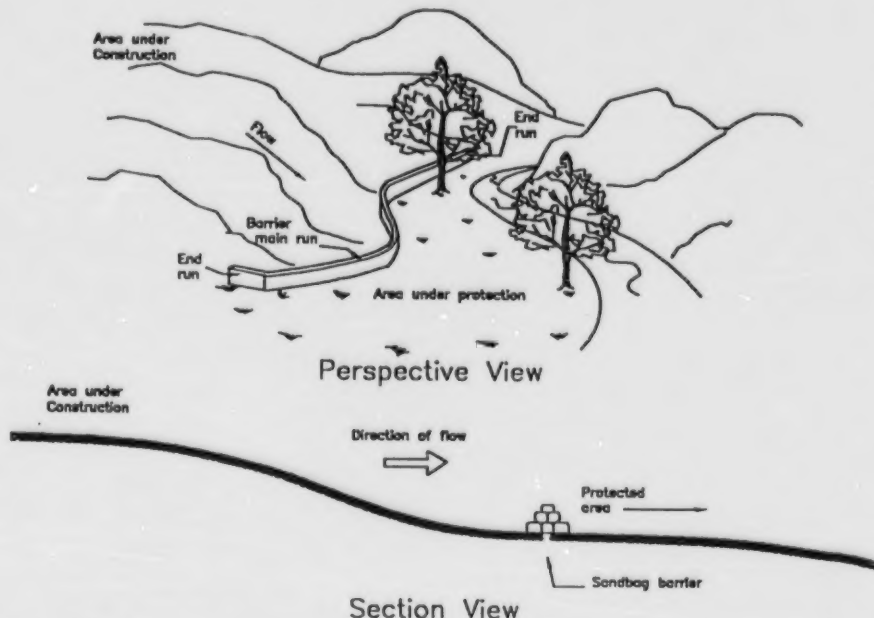
SECTION A-A

**NOTE:**

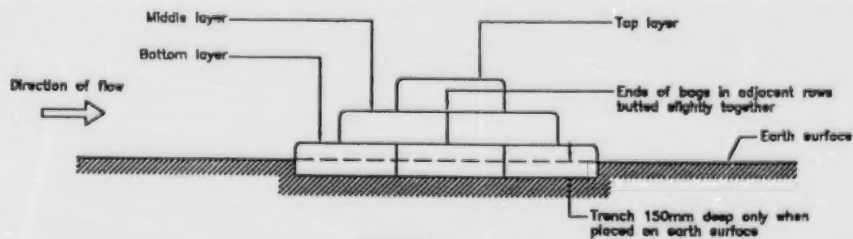
ALL DIMENSIONS ARE IN MILLIMETRES OR METRES UNLESS OTHERWISE SHOWN.

|                                                                                                                                              |                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|  <b>DEPARTMENT OF TRANSPORTATION<br/>AND PUBLIC WORKS</b> |                                                                                               |
| <b>BERM BARRIER</b>                                                                                                                          |                                                                                               |
| Drawn by: M.W.L.<br>Date: Dec. 02, 1996                                                                                                      | Approved by: M. Pertus<br>Title: Manager, Highway<br>and Bridge Design<br>Date: Dec. 16, 1996 |
| Dwg. No. HS703.DWG                                                                                                                           |                                                                                               |

## Division 8 Standard Drawings



Plan of Sandbag Barrier



## NOTE:

All dimensions in millimetres or metres unless otherwise shown



DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## SANDBAG BARRIER

Drawn by: M.W.L.

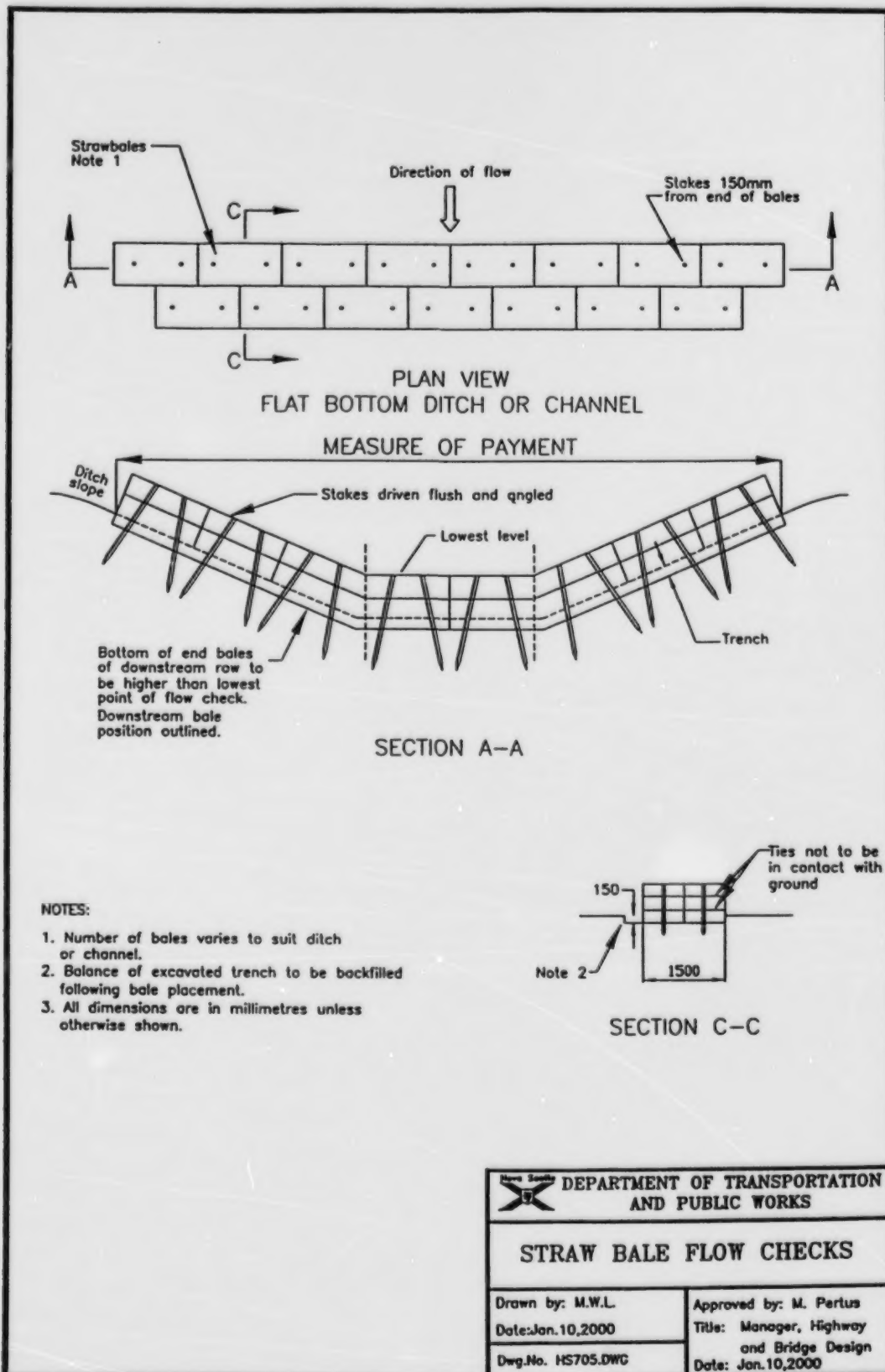
Date: Dec. 02, 1996

Dwg. No. HS704.DWG

Approved by: M. Pertus

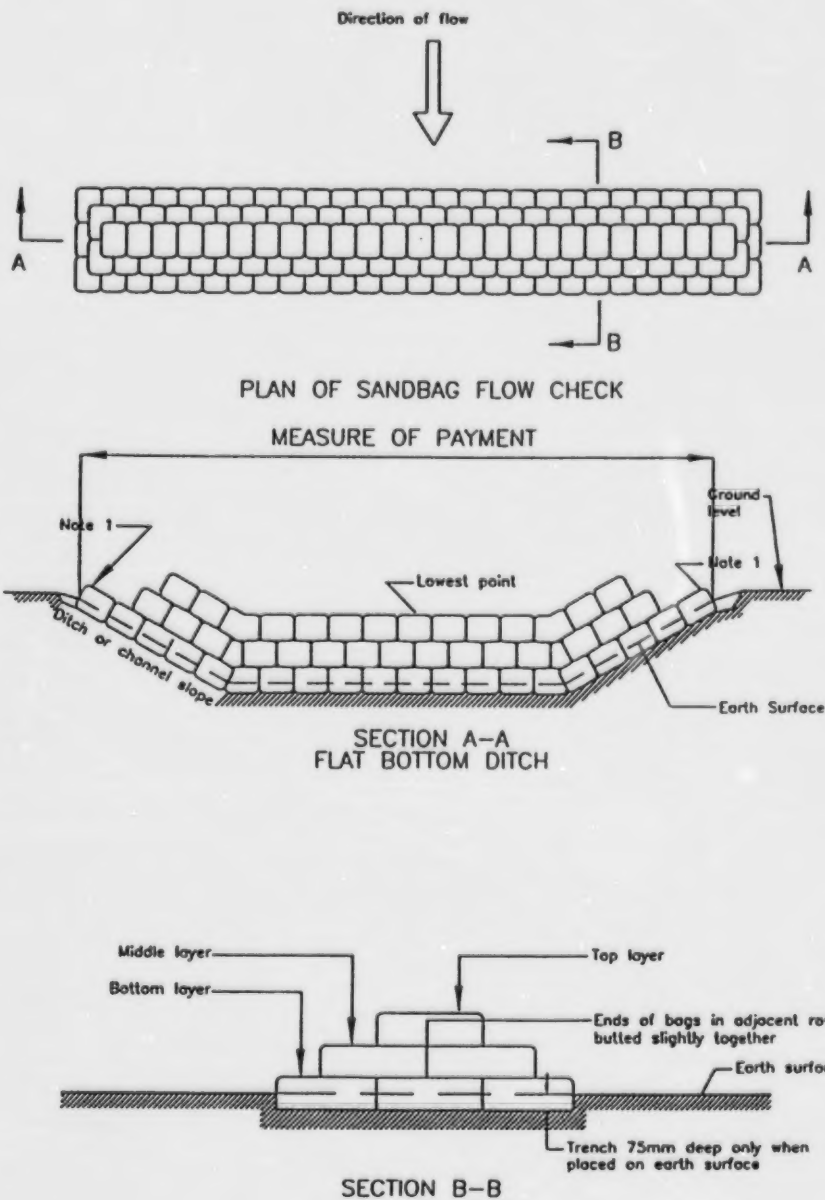
Title: Manager, Highway  
and Bridge Design  
Date: Dec. 16, 1996

Division 8 Standard Drawings



|                                                                                                                                              |                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|  <b>DEPARTMENT OF TRANSPORTATION<br/>AND PUBLIC WORKS</b> |                                                                                               |
| <b>STRAW BALE FLOW CHECKS</b>                                                                                                                |                                                                                               |
| Drawn by: M.W.L.<br>Date: Jan. 10, 2000<br>Dwg. No. HS705.DWC                                                                                | Approved by: M. Pertus<br>Title: Manager, Highway<br>and Bridge Design<br>Date: Jan. 10, 2000 |

Division 8 Standard Drawings

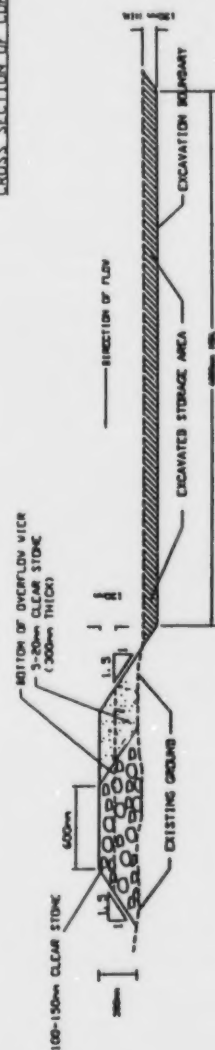
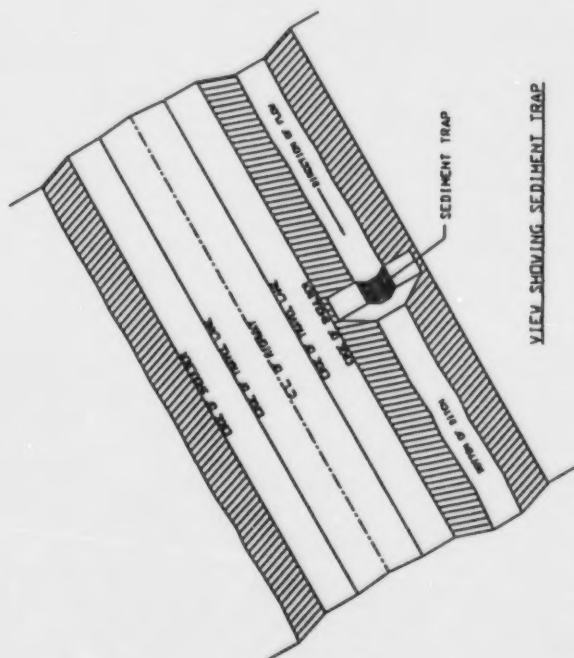
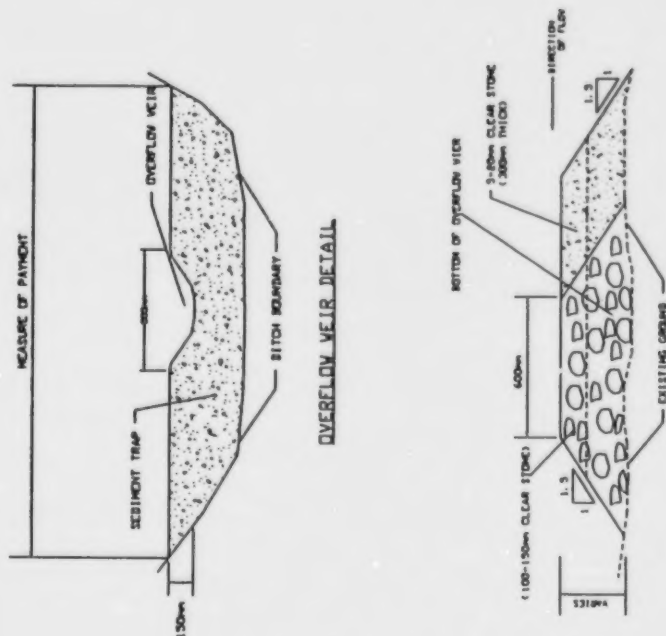


NOTES:

1. End of flow check at ground level to be higher than the lowest point of flow check. Sufficient sandbags are to be placed to prevent scouring.
2. All dimensions are in millimetres or metres unless otherwise shown.

|                                                                                                                                              |                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|  <b>DEPARTMENT OF TRANSPORTATION<br/>AND PUBLIC WORKS</b> |                                                                                               |
| <b>SANDBAG FLOW CHECKS</b>                                                                                                                   |                                                                                               |
| Drawn by: M.W.L.<br>Date: Jan. 10, 2000<br>Dwg. No. HS706.DWG                                                                                | Approved by: M. Pertus<br>Title: Manager, Highway<br>and Bridge Design<br>Date: Jan. 10, 2000 |

## Division 8 Standard Drawings



DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS

## ROCK FLOW CHECKS

Drawn by: M.W.L.

Approved by: M. Peddie

Date: Jan. 10, 2000

**Title:** Manager, Highway

Dwg. No. HS707.DWG

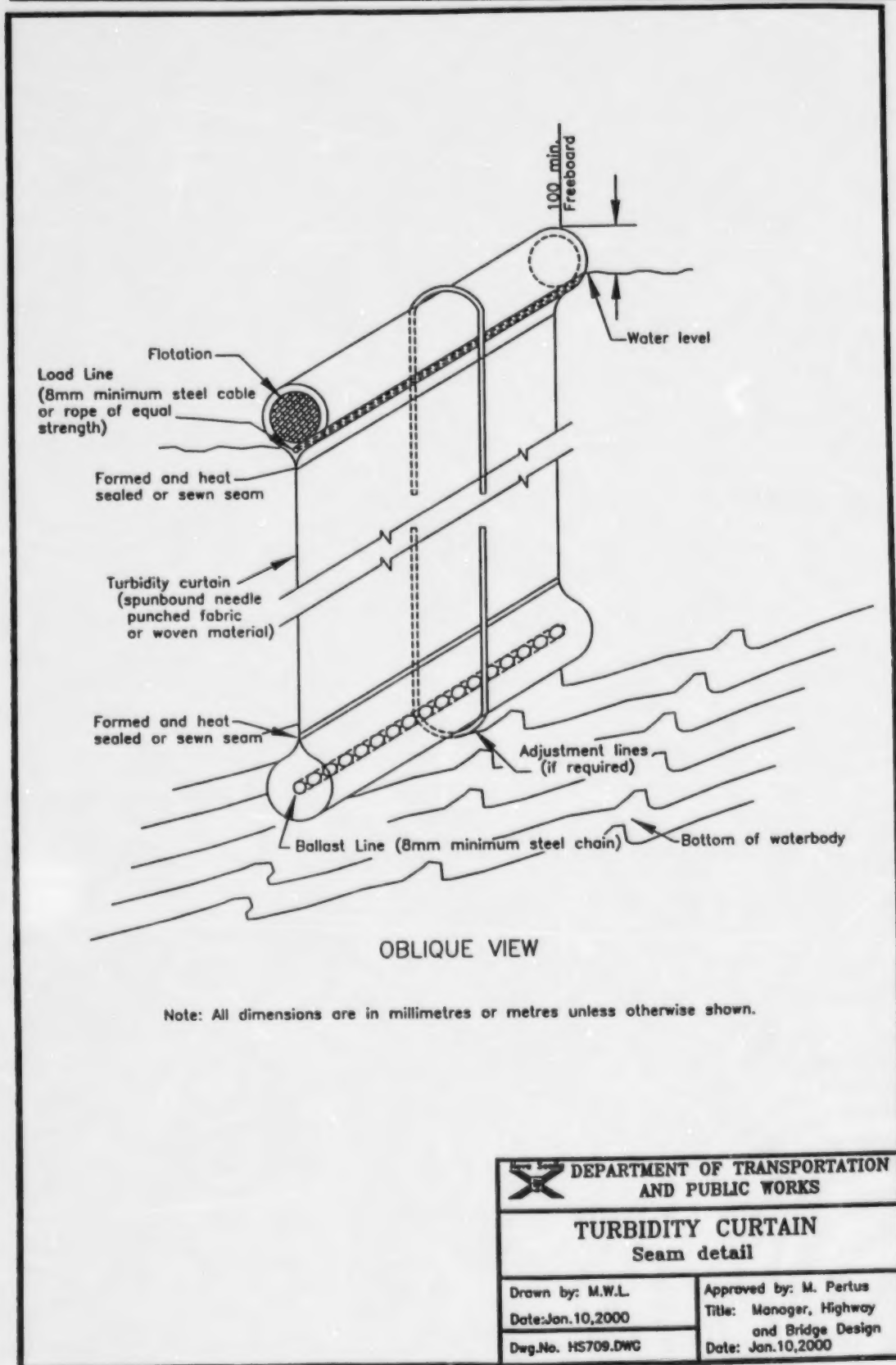
**and Bridge Design**  
**Date: Jan. 10, 2000**

Date: Jan. 10, 2000

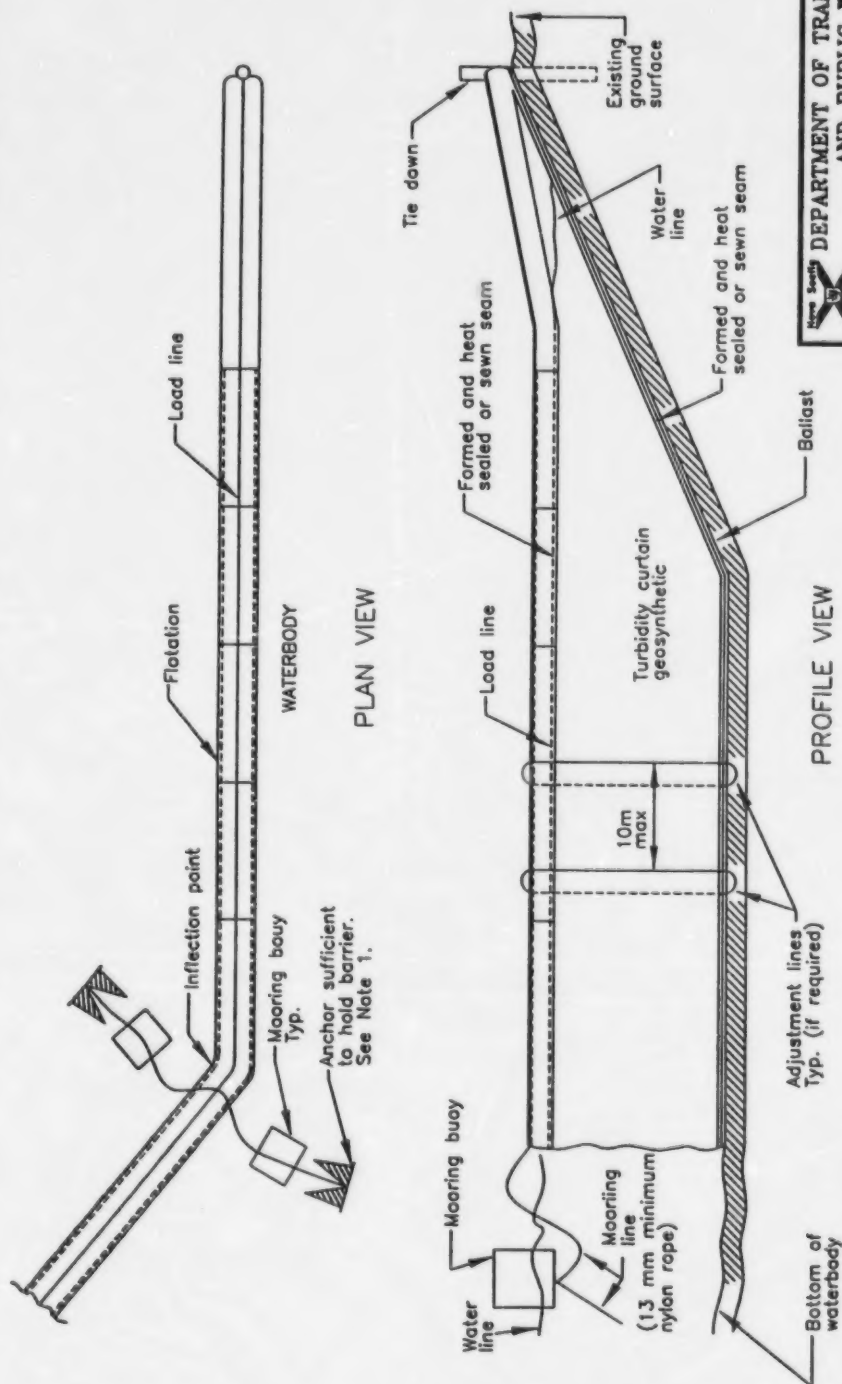




## Division 8 Standard Drawings



Division 8 Standard Drawings



Note: Anchoring is to provide positive positioning for turbidity curtain. All dimensions are in millimetres unless otherwise shown.


**DEPARTMENT OF TRANSPORTATION  
AND PUBLIC WORKS**

**TURBIDITY CURTAIN**

|                     |                         |
|---------------------|-------------------------|
| Drawn by: M.W.L.    | Approved by: M. Pertus  |
| Date: Jan. 10, 2000 | Title: Manager, Highway |
| Eng. No. HS710.DWG  | Date: Jan. 10, 2000     |

Nova Scotia

Department of  
Transportation  
and Public Works

**TENDER**

**TO THE DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS ,  
HALIFAX, NOVA SCOTIA: -**

The undersigned Bidder has carefully examined the site of the work described herein; has become familiar with local conditions and the character and extent of the work; has carefully examined every part of the proposed Contract and thoroughly understands its stipulations, requirements and provisions.

The undersigned Bidder has determined the quality and quantity of materials required; has investigated the location and determined the sources of supply of the materials required; has investigated labour conditions and has arranged for the continuous prosecution of the work herein described.

The undersigned Bidder hereby agrees to be bound by the award of the Contract and if awarded the Contract on this Tender to execute the required Contract within ten days after notice of award.

The undersigned Bidder further agrees to provide all necessary equipment, tools, labour, incidentals and other means of construction to do all the work, and furnish all the materials of the specified requirements which are necessary to complete the work in accordance with the Contract, and agrees to accept therefor as payment in full the unit prices for the various items described in the Specifications and set forth in the Schedule of Prices in his Tender, and to do all Extra Work which may be required in connection with the construction and completion of the work under the Contract.

The undersigned Bidder understands that the quantities of work shown herein are approximate only and are subject to increase or decrease and agrees that all quantities of work, whether increased or decreased, are to be performed at the unit prices stated in the following Estimate of Quantities and Schedule of Prices for the work described.

Description of Work.

TENDER NO.  
PROJECT NO.

|                                                                      |                | TENDER NO.                   |                      | PROJECT NO.    |                  |
|----------------------------------------------------------------------|----------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                 | Unit<br>(B)    | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                      |                |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| 2.01.01 Clearing of Highway<br>(Div. 2. Sec. 1)                      | hectare        |                              |                      |                |                  |
| 2.01.02 Special Clearing<br>(Div. 2. Sec. 1)                         | hectare        |                              |                      |                |                  |
| 2.01.03 Removal of Isolated or<br>Ornamental Trees<br>(Div 2. Sec 1) | each           |                              |                      |                |                  |
| 2.01.04 Relocate Ornamental Trees<br>or Shrubs (Div 2. Sec.1)        | each           |                              |                      |                |                  |
| 2.02.01 Grubbing of Highway<br>(Div. 2. Sec. 2)                      | hectare        |                              |                      |                |                  |
| 2.02.02 Special Grubbing<br>(Div. 2. Sec. 2)                         | hectare        |                              |                      |                |                  |
| 2.03.01 Roadway & Drainage<br>Excavation Common<br>(Div. 2 Sec. 3)   | cubic<br>metre |                              |                      |                |                  |
| 2.03.02 Swamp Excavation<br>(Div. 2 Sec. 3)                          | cubic<br>metre |                              |                      |                |                  |
| 2.03.03 Solid Rock Excavation<br>(Div. 2 Sec. 3)                     | cubic<br>metre |                              |                      |                |                  |
| 2.03.04 Special Excavation<br>(Spec. Prov.)                          | cubic<br>metre |                              |                      |                |                  |
| CARRIED FORWARD \$                                                   |                |                              |                      |                |                  |

Note ! Column "D" to be completed in written form. Column "E" to be completed in numerical form.  
 . Column "F" to be completed in numerical form.

WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN



|                                                                         |                 | TENDER NO.                   |                      | PROJECT NO.    |                  |
|-------------------------------------------------------------------------|-----------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                    | Unit<br>(B)     | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                         |                 |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| 2.03.05 Ditching (Spec. Prov.)                                          | metre           |                              |                      |                |                  |
| 2.05 Borrow (Div. 2 Sec. 5)                                             | cubic<br>metre  |                              |                      |                |                  |
| 2.08 Compaction (Div. 2 Sec. 8)                                         | cubic<br>metre  |                              |                      |                |                  |
| 2.09 Water for Compaction & Dust<br>Control (Div. 2 Sec. 9)             | kilolitre       |                              |                      |                |                  |
| 2.10 Rough Grading<br>(Div. 2 Sec. 10)                                  | square<br>metre |                              |                      |                |                  |
| 2.11 Fine Grading<br>(Div. 2 Sec. 11)                                   | square<br>metre |                              |                      |                |                  |
| 2.12.01 Foundation Excavation<br>Common (Div. 2 Sec. 12)                | cubic<br>metre  |                              |                      |                |                  |
| 2.12.02 Foundation Excavation Solid<br>Rock (Div. 2 Sec. 12)            | cubic<br>metre  |                              |                      |                |                  |
| 2.13.01 Foundation Excavation<br>Common for Bridges<br>(Div. 2 Sec. 13) | cubic<br>metre  |                              |                      |                |                  |
| CARRIED FORWARD \$                                                      |                 |                              |                      |                |                  |

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|                                                                       |             | TENDER NO.                   |                                    | PROJECT NO.    |                  |
|-----------------------------------------------------------------------|-------------|------------------------------|------------------------------------|----------------|------------------|
| Specification<br>(A)                                                  | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price                         |                | Extension<br>(F) |
|                                                                       |             |                              | Written Words<br>(D)               | Figures<br>(E) |                  |
| 2.13.02 Foundation Excavation Solid Rock for Bridges (Div. 2 Sec. 13) | cubic metre |                              |                                    |                |                  |
| 2.15.01 Overhaul 300m - 599 (Div. 2 Sec. 3)                           | cubic metre |                              | FIFTY CENTS                        | 0.50           |                  |
| 2.15.02 Overhaul: 600m - 899m (Div. 2 Sec. 3)                         | cubic metre |                              | SIXTY-ONE CENTS                    | 0.61           |                  |
| 2.15.03 Overhaul: 900m - 1199m (Div. 2 Sec. 3)                        | cubic metre |                              | SEVENTY-TWO CENTS                  | 0.72           |                  |
| 2.15.04 Overhaul: 1200m - 1499m (Div. 2 Sec. 3)                       | cubic metre |                              | ONE DOLLAR AND ONE CENTS           | 1.01           |                  |
| 2.15.05 Overhaul: 1500m - 1799m (Div. 2 Sec. 3)                       | cubic metre |                              | ONE DOLLAR AND EIGHTEEN CENTS      | 1.18           |                  |
| 2.15.06 Overhaul: 1800m - 3199m (Div. 2 Sec. 3)                       | cubic metre |                              | ONE DOLLAR AND FIFTY-NINE CENTS    | 1.59           |                  |
| 2.15.07 Overhaul: 3200m - 4799m (Div. 2 Sec. 3)                       | cubic metre |                              | ONE DOLLAR AND NINETY-EIGHT CENTS  | 1.98           |                  |
| 2.15.08 Overhaul: 4800m - 6399m (Div. 2 Sec. 3)                       | cubic metre |                              | TWO DOLLARS AND THIRTY-SEVEN CENTS | 2.37           |                  |
| 3.01 Gravel Borrow (Div. 3 Sec. 1)                                    | tonne       |                              |                                    |                |                  |
| CARRIED FORWARD \$                                                    |             |                              |                                    |                |                  |

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|                                                            |             | TENDER NO.                   |                      | PROJECT NO.    |                  |
|------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                       | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                            |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
|                                                            |             |                              |                      |                |                  |
| 3.02.01 Gravel Type 1S<br>(Div. 3 Sec. 2)                  | tonne       |                              |                      |                |                  |
| 3.02.02 Gravel Type 1<br>(Div. 3 Sec. 2)                   | tonne       |                              |                      |                |                  |
| 3.02.03 Gravel Type 2<br>(Div. 3 Sec. 2)                   | tonne       |                              |                      |                |                  |
| 3.03.01 Iron Blast Furnace Slag<br>Type 1S (Div. 3 Sec. 3) | tonne       |                              |                      |                |                  |
| 3.03.02 Iron Blast Furnace Slag Type<br>1 (Div. 3 Sec. 3)  | tonne       |                              |                      |                |                  |
| 3.03.03 Iron Blast Furnace Slag<br>Type 2 (Div. 3 Sec. 3)  | tonne       |                              |                      |                |                  |
| 3.04.01 Clear Stone, C1<br>(Div. 3 Sec. 4)                 | tonne       |                              |                      |                |                  |
| 3.04.02 Clear Stone, C2<br>(Div. 3 Sec. 4)                 | tonne       |                              |                      |                |                  |
| 3.04.03 Clear Stone, C3<br>(Div. 3 Sec. 4)                 | tonne       |                              |                      |                |                  |
| CARRIED FORWARD \$                                         |             |                              |                      |                |                  |

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|                                                          |                | TENDER NO.                   |                      | PROJECT NO.    |                  |
|----------------------------------------------------------|----------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                     | Unit<br>(B)    | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                          |                |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                       |                |                              |                      |                |                  |
| 3.04.04 Clear Stone, C4<br>(Div. 3 Sec. 4)               | tonne          |                              |                      |                |                  |
| 3.04.05 Clear Stone, C5<br>(Div. 3 Sec. 4)               | tonne          |                              |                      |                |                  |
| 3.06 Loose Laid Rip-Rap<br>(Div. 3 Sec. 6)               | cubic<br>metre |                              |                      |                |                  |
| 3.07 Hand Laid Rip-Rap<br>(Div. 3 Sec. 7)                | cubic<br>metre |                              |                      |                |                  |
| 3.08.01 Armour Rock, R1<br>(Div. 3 Sec. 8)               | cubic<br>metre |                              |                      |                |                  |
| 3.08.02 Armour Rock, R2<br>(Div. 3 Sec. 8)               | cubic<br>metre |                              |                      |                |                  |
| 3.08.03 Armour Rock, R1<br>(Div. 3 Sec. 8) (Spec. Prov.) | tonne          |                              |                      |                |                  |
| 3.08.04 Armour Rock, R2<br>(Div. 3 Sec. 8) (Spec. Prov.) | tonne          |                              |                      |                |                  |
| 3.09.01 Rock Fill<br>(Div. 3 Sec. 9)                     | cubic<br>metre |                              |                      |                |                  |
| 3.09.02 Rock Fill (Div. 3 Sec. 9)<br>(Spec. Prov.)       | tonne          |                              |                      |                |                  |
| CARRIED FORWARD \$                                       |                |                              |                      |                |                  |

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| TENDER NO. PROJECT NO.                                             |                |                              |                      |                |                  |
|--------------------------------------------------------------------|----------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                               | Unit<br>(B)    | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                    |                |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                 |                |                              |                      |                |                  |
| 3.10.01 Fill Against Structure<br>(Div. 3 Sec.10)                  | tonne          |                              |                      |                |                  |
| 3.10.02 Fill Against Metal Structure<br>(Div. 3 Sec. 10)           | tonne          |                              |                      |                |                  |
| 3.11 Unshrinkable Backfill<br>(Div. 3 Sec. 11)                     | cubic<br>metre |                              |                      |                |                  |
| 4.01.01 Emulsified Asphalt Tack<br>(Div. 4 Sec. 1)                 | litre          |                              |                      |                |                  |
| 4.02 Asphalt Cement<br>(Div. 4 Sec. 2) (Spec. Prov.)               | tonne          |                              |                      |                |                  |
| 4.03.01 Asphalt Concrete Curbs<br>(Div. 4 Sec. 3)                  | metre          |                              |                      |                |                  |
| 4.03.02 Asphalt Concrete Gutters<br>(Div. 4 Sec. 3)                | metre          |                              |                      |                |                  |
| 4.03.03 Asphalt Concrete Medians<br>(Spec. Prov.)                  | metre          |                              |                      |                |                  |
| 4.04.01 Asphalt Concrete Type 'C'<br>(Div. 4 Sec. 4) (Spec. Prov.) | tonne          |                              |                      |                |                  |
| CARRIED FORWARD \$                                                 |                |                              |                      |                |                  |

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TENDER NO. PROJECT NO.

| Specification<br>(A)                                                        | Unit<br>(B)  | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|-----------------------------------------------------------------------------|--------------|------------------------------|----------------------|----------------|------------------|
|                                                                             |              |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                          |              |                              |                      |                |                  |
| 4.04.02 Asphalt Concrete Type 'C-HF' (Div. 4 Sec. 4) (Spec. Prov.)          | tonne        |                              |                      |                |                  |
| 4.04.03 Asphalt Concrete Type 'B' (Div. 4 Sec. 4) (Spec. Prov.)             | tonne        |                              |                      |                |                  |
| 4.04.04 Asphalt Concrete Type 'B-HF' (Div. 4 Sec. 4) (Spec. Prov.)          | tonne        |                              |                      |                |                  |
| 4.04.05 Asphalt Concrete Type 'Modified C-HF' (Div. 4 Sec. 4) (Spec. Prov.) | tonne        |                              |                      |                |                  |
| 4.04.06 Cold In-Place Recycled Asphalt (Spec. Prov.)                        | square metre |                              |                      |                |                  |
| 4.05 Liquid Asphalt Primer (Div. 4 Sec. 5)                                  | litre        |                              |                      |                |                  |
| 4.06 Removal of Asphalt Concrete (Div. 4 Sec. 6)                            | square metre |                              |                      |                |                  |
| 4.07 Asphalt Concrete Patching (Div. 4 Sec. 7)                              | tonne        |                              |                      |                |                  |
| 4.08 Asphalt Concrete Paving of Bridge Decks (Div. 4 Sec. 8)                | tonne        |                              |                      |                |                  |
| CARRIED FORWARD \$                                                          |              |                              |                      |                |                  |

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TENDER NO. PROJECT NO.

| Specification<br>(A)                                                                                     | Unit<br>(B)  | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|----------------------------------------------------------------------------------------------------------|--------------|------------------------------|----------------------|----------------|------------------|
|                                                                                                          |              |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                                                       |              |                              |                      |                |                  |
| 4.09.01 Supply & Application of Graded Aggregate Seal (Two Courses) (Div. 4 Sec. 9)                      | square metre |                              |                      |                |                  |
| 4.10.01 Supply & Application of Graded Aggregate Seal (One Course) (Div. 4 Sec. 10)                      | square metre |                              |                      |                |                  |
| 4.11 Crack Filling and Crack Sealing (EPWS) (Div. 4 Sec. 11)                                             | linear metre |                              |                      |                |                  |
| 4.12 Seal Coat (EPWS) (Div. 4 Sec. 12)                                                                   | square metre |                              |                      |                |                  |
| 4.13 Reclaimed Asphalt Concrete (Div. 4 Sec. 13)                                                         | square metre |                              |                      |                |                  |
| 4.14 Sand Seal Surface Treatment (Div. 4 Sec. 14)                                                        | cubic metre  |                              |                      |                |                  |
| 4.15 Cold Mix For Winter Patching (Div. 4 Sec. 15)                                                       | tonne        |                              |                      |                |                  |
| 4.16 Micro-Surfacing (EPWS) (Div. 4 Sec. 16)                                                             | litre        |                              |                      |                |                  |
| 4.17.01 Supply & Install Geotextile For Portland Cement Concrete Pavement (Div. 4 Sec. 17) (Spec. Prov.) | square metre |                              |                      |                |                  |
| CARRIED FORWARD \$                                                                                       |              |                              |                      |                |                  |

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|                                                                                       |                 | TENDER NO.                   |                      | PROJECT NO.    |                  |
|---------------------------------------------------------------------------------------|-----------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                                  | Unit<br>(B)     | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                                       |                 |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                                    |                 |                              |                      |                |                  |
| 4.17.02 Granular Subbase For<br>Portland Cement Concrete<br>Pavement (Div. 4 Sec. 17) | tonne           |                              |                      |                |                  |
| 4.17.03 Portland Cement Concrete<br>Pavement (Div. 4 Sec. 17)                         | square<br>metre |                              |                      |                |                  |
| 4.18 Roller Compacted Concrete<br>Pavement (EPWS)<br>(Div. 4 Sec. 18)                 | square<br>metre |                              |                      |                |                  |
| 4.19 Cold Planing<br>(Spec. Prov.)                                                    | square<br>metre |                              |                      |                |                  |
| 4.20 Pulverization<br>(Spec. Prov.)                                                   | square<br>metre |                              |                      |                |                  |
| 5.01.01 Timber Piles<br>(Div. 5 Sec. 1)                                               | metre           |                              |                      |                |                  |
| 5.01.02 Steel Sheet Piles Delivered<br>(Div. 5 Sec. 1)                                | square<br>metre |                              |                      |                |                  |
| 5.01.03 Steel H-Piles Delivered<br>(Div. 5 Sec. 1)                                    | metre           |                              |                      |                |                  |
| 5.01.04 Steel H - Piles Driven<br>(Div. 5 Sec. 1)                                     | metre           |                              |                      |                |                  |
| 5.01.05 Steel Sheet Piles Driven<br>(Div. 5 Sec.1)                                    | square<br>metre |                              |                      |                |                  |
| CARRIED FORWARD \$                                                                    |                 |                              |                      |                |                  |

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|                                                                     |             | TENDER NO.                   |                      | PROJECT NO.    |                  |
|---------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                     |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                  |             |                              |                      |                |                  |
|                                                                     |             |                              |                      |                |                  |
| 5.01.06 Mobilization of Pile Driving Equipment<br>(Div. 5 Sec. 1)   | lump sum    |                              |                      |                |                  |
| 5.02.01 Timber Structures<br>(Div. 5 Sec. 2)                        | cubic metre |                              |                      |                |                  |
| 5.02.02 Timber Crib Work<br>(Div. 5 Sec.2)                          | cubic metre |                              |                      |                |                  |
| 5.03 Structural Steel<br>(Div.5 Sec.3)                              | lump sum    |                              |                      |                |                  |
| 5.04 Miscellaneous Metal<br>(Div.5 Sec.4)                           | kilogram    |                              |                      |                |                  |
| 5.05.01 Uncoated Reinforcing Steel<br>Delivered (Div.5 Sec.5)       | kilogram    |                              |                      |                |                  |
| 5.05.02 Placing of Uncoated Reinforcing Steel<br>(Div.5 Sec.5)      | kilogram    |                              |                      |                |                  |
| 5.05.03 Epoxy Coated Reinforcing Steel<br>Delivered (Div. 5 Sec. 5) | kilogram    |                              |                      |                |                  |
| 5.05.04 Placing of Epoxy Coated Reinforcing Steel<br>(Div.5 Sec. 5) | kilogram    |                              |                      |                |                  |
| CARRIED FORWARD \$                                                  |             |                              |                      |                |                  |

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TENDER NO. PROJECT NO.

| Specification<br>(A)                                                       | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|----------------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
|                                                                            |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                         |             |                              |                      |                |                  |
| 5.06.01 Erect Steel Guard Rail<br>(Div. 5 Sec.6)                           | metre       |                              |                      |                |                  |
| 5.06.02 Erect Steel Guard Rail for<br>Column Protection<br>(Div. 5 Sec. 6) | metre       |                              |                      |                |                  |
| 5.06.03 Erect Steel Guard Rail for<br>Bridge Approaches<br>(Div. 5 Sec. 6) | metre       |                              |                      |                |                  |
| 5.06.04 Removal of Steel Guard Rail<br>(Div. 5 Sec. 6) (Spec. Prov.)       | metre       |                              |                      |                |                  |
| 5.06.05 Adjust Steel Guard Rail<br>(Div. 5 Sec. 6)                         | metre       |                              |                      |                |                  |
| 5.06.06 Replace Guard Rail Sections<br>(Div. 5 Sec.6)                      | metre       |                              |                      |                |                  |
| 5.06.07 Double Cable Guard Rail<br>(Spec. Prov.)                           | metre       |                              |                      |                |                  |
| 5.06.08 Removal of Double Cable<br>Guard Rail (Spec. Prov.)                | metre       |                              |                      |                |                  |
| 5.06.09 Adjust Double Cable Guard<br>Rail (Spec. Prov.)                    | metre       |                              |                      |                |                  |
| 5.06.10 Wooden Guide Posts in<br>Place (Div. 5 Sec. 6)                     | each        |                              |                      |                |                  |
| CARRIED FORWARD \$                                                         |             |                              |                      |                |                  |

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| TENDER NO. PROJECT NO.                                                     |             |                              |                      |                |                  |
|----------------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                       | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                            |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                         |             |                              |                      |                |                  |
|                                                                            |             |                              |                      |                |                  |
| 5.06.11 Removal of Wooden Guide Posts (Div. 5 Sec. 6)<br>(Spec. Prov.)     | each        |                              |                      |                |                  |
| 5.06.12 Adjust Wooden Guide Posts (Div. 5 Sec. 6)                          | each        |                              |                      |                |                  |
| 5.06.13 Remove & Replace Steel Guard Rail (Div. 5 Sec. 6)<br>(Spec. Prov.) | metre       |                              |                      |                |                  |
| 5.07.01 Cast in Place Concrete Non-Reinforced (Div. 5 Sec. 7)              | cubic metre |                              |                      |                |                  |
| 5.07.02 Cast in Place Concrete Reinforced (Div. 5 Sec. 7)                  | cubic metre |                              |                      |                |                  |
| 5.07.03 Concrete Curb and Gutter Type "A" (Div. 5 Sec. 7)                  | metre       |                              |                      |                |                  |
| 5.07.04 Concrete Curb & Gutter Type "B" (Div. 5 Sec. 7)                    | metre       |                              |                      |                |                  |
| 5.07.05 Concrete Curb & Gutter Type "C" (Div. 5 Sec. 7)                    | metre       |                              |                      |                |                  |
| 5.07.06 Concrete Curb Type "D" (Div. 5 Sec. 7)                             | metre       |                              |                      |                |                  |
| CARRIED FORWARD \$                                                         |             |                              |                      |                |                  |

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WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN

TENDER NO. PROJECT NO.

| Specification<br>(A) |                                                             | Unit<br>(B)     | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|----------------------|-------------------------------------------------------------|-----------------|------------------------------|----------------------|----------------|------------------|
|                      |                                                             |                 |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$   |                                                             |                 |                              |                      |                |                  |
| 5.07.07              | Concrete Curb Type "E"<br>(Div. 5 Sec. 7)                   | metre           |                              |                      |                |                  |
| 5.07.08              | Concrete Curb Type "F"<br>(Div. 5 Sec. 7)                   | metre           |                              |                      |                |                  |
| 5.07.09              | Concrete Sidewalks<br>(Div. 5 Sec. 7)                       | square<br>metre |                              |                      |                |                  |
| 5.07.10              | Concrete Driveway Entrances<br>(Div. 5 Sec. 7)              | square<br>metre |                              |                      |                |                  |
| 5.07.11              | Concrete Jersey Barrier<br>(Spec. Prov.)<br>(Div. 5 Sec. 7) | metre           |                              |                      |                |                  |
| 5.07.12              | Cast in Place Concrete Catch<br>Basins (Div. 5 Sec. 7)      | cubic<br>metre  |                              |                      |                |                  |
| 5.07.13              | Concrete in Bridge Decks<br>(Div. 5 Sec. 7)                 | cubic<br>metre  |                              |                      |                |                  |
| 5.07.14              | Cast in Place Concrete Catch<br>Basins (Div. 5 Sec. 7)      | lump sum        |                              |                      |                |                  |
| 5.08                 | Precast Prestressed<br>Concrete Girders (Div. 5<br>Sec. 8)  | lump sum        |                              |                      |                |                  |
| CARRIED FORWARD \$   |                                                             |                 |                              |                      |                |                  |

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WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN

|                      |                                                                        | TENDER NO.                   |                      | PROJECT NO.    |                  |
|----------------------|------------------------------------------------------------------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A) | Unit<br>(B)                                                            | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                      |                                                                        |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$   |                                                                        |                              |                      |                |                  |
| 5.09                 | Waterproofing Concrete<br>Bridge Decks (Div. 5 Sec.<br>9)              | square<br>metre              |                      |                |                  |
| 5.10                 | Structural Plate Pipe<br>(Spec. Prov.)<br>(Div. 5 Sec. 10)             | metre                        |                      |                |                  |
| 5.11                 | Aluminum Guardrail<br>(Div. 5 Sec. 11)                                 | metre                        |                      |                |                  |
| 5.12.01              | Supply & Lay Concrete Pipe<br>300mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre                        |                      |                |                  |
| 5.12.02              | Supply & Lay Concrete Pipe<br>375mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre                        |                      |                |                  |
| 5.12.03              | Supply & Lay Concrete Pipe<br>450mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre                        |                      |                |                  |
| 5.12.04              | Supply & Lay Concrete Pipe<br>600mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre                        |                      |                |                  |
| 5.12.05              | Supply & Lay Concrete Pipe<br>750mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre                        |                      |                |                  |
| 5.12.06              | Supply & Lay Concrete Pipe<br>900mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre                        |                      |                |                  |
| CARRIED FORWARD \$   |                                                                        |                              |                      |                |                  |

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WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN

TENDER NO. PROJECT NO.

| Specification<br>(A)                                                            | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|---------------------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
|                                                                                 |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                              |             |                              |                      |                |                  |
| 5.12.07 Supply & Lay Concrete Pipe<br>1200mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.08 Supply & Lay Concrete Pipe<br>1500mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.09 Supply & Lay Concrete Pipe<br>1800mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.10 Supply & Lay Concrete Pipe<br>2100mm dia. Class 65D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.11 Supply & Lay Concrete Pipe<br>300mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.12 Supply & Lay Concrete Pipe<br>375mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.13 Supply & Lay Concrete Pipe<br>450mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.14 Supply & Lay Concrete Pipe<br>600mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.15 Supply & Lay Concrete Pipe<br>750mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| CARRIED FORWARD \$                                                              |             |                              |                      |                |                  |

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WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN

|                                                                                  |             | TENDER NO.                   |                      | PROJECT NO.    |                  |
|----------------------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                             | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                                  |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                               |             |                              |                      |                |                  |
| 5.12.16 Supply & Lay Concrete Pipe<br>900mm dia. Class 100D<br>(Div. 5 Sec. 12)  | metre       |                              |                      |                |                  |
| 5.12.17 Supply & Lay Concrete Pipe<br>1200mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.18 Supply & Lay Concrete Pipe<br>1500mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.19 Supply & Lay Concrete Pipe<br>1800mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.20 Supply & Lay Concrete Pipe<br>2100mm dia. Class 100D<br>(Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.21 Supply & Lay Concrete Pipe<br>300mm dia. Class 140D<br>(Div. 5 Sec. 12)  | metre       |                              |                      |                |                  |
| 5.12.22 Supply & Lay Concrete Pipe<br>375mm dia. Class 140D<br>(Div. 5 Sec. 12)  | metre       |                              |                      |                |                  |
| 5.12.23 Supply & Lay Concrete Pipe<br>450mm dia. Class 140D<br>(Div. 5 Sec. 12)  | metre       |                              |                      |                |                  |
| 5.12.24 Supply & Lay Concrete Pipe<br>600mm dia. Class 140D<br>(Div. 5 Sec. 12)  | metre       |                              |                      |                |                  |
| CARRIED FORWARD \$                                                               |             |                              |                      |                |                  |

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WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN



TENDER NO. PROJECT NO.

| Specification<br>(A) |                                                                                 | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|----------------------|---------------------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
|                      |                                                                                 |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$   |                                                                                 |             |                              |                      |                |                  |
| 5.12.25              | Supply & Lay Concrete Pipe<br>750mm dia. Class 140D<br>(Div. 5 Sec. 12)         | metre       |                              |                      |                |                  |
| 5.12.26              | Supply & Lay Concrete Pipe<br>900mm dia. Class 140D<br>(Div. 5 Sec. 12)         | metre       |                              |                      |                |                  |
| 5.12.27              | Supply & Lay Concrete Pipe<br>1200mm dia. Class 140D<br>(Div. 5 Sec. 12)        | metre       |                              |                      |                |                  |
| 5.12.28              | Supply & Lay Concrete Pipe<br>1500mm dia. Class 140D<br>(Div. 5 Sec. 12)        | metre       |                              |                      |                |                  |
| 5.12.29              | Supply & Lay Concrete Pipe<br>1800mm dia. Class 140D<br>(Div. 5 Sec. 12)        | metre       |                              |                      |                |                  |
| 5.12.30              | Supply & Lay Concrete Pipe<br>2100mm dia. Class 140D<br>(Div. 5 Sec. 12)        | metre       |                              |                      |                |                  |
| 5.12.31              | Supply & Lay Concrete Pipe<br>1200mm dia. With Fish<br>Baffles (Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.32              | Supply & Lay Concrete Pipe<br>1500mm dia. With Fish<br>Baffles (Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| 5.12.33              | Supply & Lay Concrete Pipe<br>1800mm dia. With Fish<br>Baffles (Div. 5 Sec. 12) | metre       |                              |                      |                |                  |
| CARRIED FORWARD \$   |                                                                                 |             |                              |                      |                |                  |

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WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN

|                      |                                                                                | TENDER NO.                   |                      | PROJECT NO.    |                  |
|----------------------|--------------------------------------------------------------------------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A) | Unit<br>(B)                                                                    | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                      |                                                                                |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$   |                                                                                |                              |                      |                |                  |
| 5.12.34              | Suply & Lay Concrete Pipe<br>2100mm dia. With Fish<br>Baffles (Div. 5 Sec. 12) | metre                        |                      |                |                  |
| 5.12.35              | Supply & Lay Corrugated<br>Steel Pipe 300mm dia.<br>(Div. 5 Sec.12)            | metre                        |                      |                |                  |
| 5.12.36              | Supply & Lay Corrugated<br>Steel Pipe 400mm dia.<br>(Div. 5 Sec. 12)           | metre                        |                      |                |                  |
| 5.12.37              | Supply & Lay Corrugated<br>Steel Pipe 500mm dia.<br>(Div. 5 Sec. 12)           | metre                        |                      |                |                  |
| 5.12.38              | Supply & Lay Corrugated<br>Steel Pipe 600mm dia.<br>(Div. 5 Sec. 12)           | metre                        |                      |                |                  |
| 5.12.39              | Supply & Lay Corrugated<br>Steel Pipe 800mm dia.<br>(Div. 5 Sec. 12)           | metre                        |                      |                |                  |
| 5.12.40              | Supply & Lay Corrugated<br>Aluminum Alloy Pipe 400mm<br>dia. (Div. 5 Sec. 12)  | metre                        |                      |                |                  |
| 5.12.41              | Supply & Lay Corrugated<br>Aluminum Alloy Pipe 500mm<br>dia. (Div. 5 Sec. 12)  | metre                        |                      |                |                  |
| 5.12.42              | Supply & Lay Corrugated<br>Aluminum Alloy Pipe 600mm<br>dia. (Div. 5 Sec. 12)  | metre                        |                      |                |                  |
| CARRIED FORWARD \$   |                                                                                |                              |                      |                |                  |

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TENDER NO. PROJECT NO.

| Specification<br>(A)                                                               | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|------------------------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
|                                                                                    |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                                 |             |                              |                      |                |                  |
| 5.12.43 Supply & Lay Corrugated Aluminum Alloy Pipe 800mm dia. (Div. 5 Sec. 12)    | metre       |                              |                      |                |                  |
| 5.12.44 Supply & Lay Plastic Pipe 100mm dia. (Div. 5 Sec. 12)                      | metre       |                              |                      |                |                  |
| 5.12.45 Supply & Lay Plastic Pipe 200mm dia. (Div. 5 Sec. 12)                      | metre       |                              |                      |                |                  |
| 5.12.46 Supply & Lay Plastic Pipe 300mm dia. (Div. 5 Sec. 12)                      | metre       |                              |                      |                |                  |
| 5.12.47 Supply & Lay Perforated Plastic Pipe 100mm dia. (Div. 5 Sec. 12)           | metre       |                              |                      |                |                  |
| 5.12.48 Supply & Lay Perforated Plastic Pipe 200mm dia. (Div. 5 Sec. 12)           | metre       |                              |                      |                |                  |
| 5.12.49 Removal of Driveway Culverts (Div. 5 Sec. 12)                              | metre       |                              |                      |                |                  |
| 5.12.50 Supply & Install 750mm dia. Precast Concrete Catch Basin (Div. 5 Sec. 12)  | each        |                              |                      |                |                  |
| 5.12.51 Supply & Install 1050mm dia. Precast Concrete Catch Basin (Div. 5 Sec. 12) | each        |                              |                      |                |                  |
| CARRIED FORWARD \$                                                                 |             |                              |                      |                |                  |

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WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN

|                                                                                          |             | TENDER NO.                   |                      | PROJECT NO.    |                  |
|------------------------------------------------------------------------------------------|-------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                                     | Unit<br>(B) | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                                          |             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                                       |             |                              |                      |                |                  |
| 5.12.52 Supply & Install 1200mm dia.<br>Precast Concrete Catch<br>Basin (Div. 5 Sec. 12) | each        |                              |                      |                |                  |
| 5.12.53 Removal of Existing<br>Manhole/Catch Basin<br>(Div. 5 Sec. 12)                   | each        |                              |                      |                |                  |
| 5.12.54 Adjustment of<br>Manholes/Catch Basins<br>(Div. 5 Sec. 12)                       | each        |                              |                      |                |                  |
| 5.12.55 Adjustment of Water Valves<br>(Spec. Prov.)                                      | each        |                              |                      |                |                  |
| 5.12.56 Repairs to Manholes<br>(Div. 5 Sec.12)                                           | each        |                              |                      |                |                  |
| 5.12.57 Repairs to Catch Basins<br>(Div. 5 Sec.12)                                       | each        |                              |                      |                |                  |
| 5.12.59 Repairs to Water Valves<br>(Spec. Prov.)                                         | each        |                              |                      |                |                  |
| 5.12.60 Lay Existing Metal Pipe<br>400mm dia. (Div. 5 Sec. 12)                           | metre       |                              |                      |                |                  |
| 5.12.61 Lay Existing Metal Pipe<br>500mm dia. (Div. 5 Sec. 12)                           | metre       |                              |                      |                |                  |
| 5.12.62 Lay Existing Metal Pipe<br>600mm dia. (Div. 5 Sec. 12)                           | metre       |                              |                      |                |                  |
| CARRIED FORWARD \$                                                                       |             |                              |                      |                |                  |

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| TENDER NO. PROJECT NO.                                                           |              |                              |                      |                |                  |
|----------------------------------------------------------------------------------|--------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                             | Unit<br>(B)  | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                                  |              |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                               |              |                              |                      |                |                  |
|                                                                                  |              |                              |                      |                |                  |
| 5.12.63 Lay Aluminized Pipe 400 mm dia. (Div. 5 Sec. 12)                         | metre        |                              |                      |                |                  |
| 5.12.64 Lay Aluminized Pipe 500 mm dia. (Div. 5 Sec. 12)                         | metre        |                              |                      |                |                  |
| 5.12.65 Lay Aluminized Pipe 600 mm dia. (Div. 5 Sec. 12)                         | metre        |                              |                      |                |                  |
| 5.12.66 Supply & Lay Corrugated Steel Pipe 700mm Dia. (Div. 5 Sec. 12)           | metre        |                              |                      |                |                  |
| 5.12.67 Supply & Lay Corrugated Steel Pipe 900mm Dia. (Div. 5 Sec. 12)           | metre        |                              |                      |                |                  |
| 5.12.68 Supply & Lay Corrugated Steel Pipe 1200mm Dia. (Div. 5 Sec. 12)          | metre        |                              |                      |                |                  |
| 5.13.01 Asphalt Concrete Removal From Bridge Deck - Restoration (Div. 5 Sec. 13) | square metre |                              |                      |                |                  |
| 5.13.02 Concrete Removal on Bridge Decks - Restoration (Div. 5 Sec. 13)          | square metre |                              |                      |                |                  |
| 5.13.03 Soffit Repairs - Bridge Deck Restoration (Div. 5 Sec. 13)                | square metre |                              |                      |                |                  |
| CARRIED FORWARD \$                                                               |              |                              |                      |                |                  |

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TENDER NO. PROJECT NO.

| Specification<br>(A)                                                                            | Unit<br>(B)  | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|-------------------------------------------------------------------------------------------------|--------------|------------------------------|----------------------|----------------|------------------|
|                                                                                                 |              |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                                              |              |                              |                      |                |                  |
| 5.13.04 Through Repairs - Bridge Restoration (Div. 5 Sec. 13)                                   | square metre |                              |                      |                |                  |
| 5.13.05 End Posts/Intermediate Posts (Div. 5 Sec. 13) (Spec. Prov.)                             | each         |                              |                      |                |                  |
| 5.14 Inextensible Mechanically Stabilized Earth (MSE) Structures (Div. 5 Sec. 14) (Spec. Prov.) | lump sum     |                              |                      |                |                  |
| 5.15 Asphaltic Plug Joints (Div. 5 Sec. 15)                                                     | each         |                              |                      |                |                  |
| 6.01 Traffic Control Persons (Div. 6 Sec. 1)                                                    | hour         |                              |                      |                |                  |
| 6.02 Flashing Light Units (Div. 6 Sec. 2)                                                       | hour         |                              |                      |                |                  |
| 6.03.01 Chain Link Fence (Div. 6 Sec. 3)                                                        | metre        |                              |                      |                |                  |
| 6.03.02 Chain Link Fence Gates (Div. 6 Sec. 3)                                                  | each         |                              |                      |                |                  |
| 6.04.01 Right-of-Way Wire Fence Type "A" (Div. 6 Sec. 4)                                        | metre        |                              |                      |                |                  |
| CARRIED FORWARD \$                                                                              |              |                              |                      |                |                  |

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| Specification<br>(A) |                                                                       | Unit<br>(B)     | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|----------------------|-----------------------------------------------------------------------|-----------------|------------------------------|----------------------|----------------|------------------|
|                      |                                                                       |                 |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$   |                                                                       |                 |                              |                      |                |                  |
| 6.04.02              | Right-of-Way Wire Fence<br>Type "B" (Div.6 Sec.4)                     | metre           |                              |                      |                |                  |
| 6.04.03              | Right-of-Way Fence Steel<br>Gates (Div.6 Sec.4)                       | metre           |                              |                      |                |                  |
| 6.05.01              | Removal of Curbs<br>(Div. 6 Sec. 5)                                   | metre           |                              |                      |                |                  |
| 6.05.02              | Removal of Sidewalks<br>(Div. 6 Sec. 5)                               | square<br>metre |                              |                      |                |                  |
| 6.06                 | Supply & Application of Non-<br>Coning Traffic Paint<br>(Div.6 Sec.6) | line-km         |                              |                      |                |                  |
| 6.07                 | Calcium Chloride Water<br>Solution (Div. 6 Sec. 7)                    | kilogram        |                              |                      |                |                  |
| 6.08                 | Calcium Chloride<br>(Div. 6 Sec. 8)                                   | kilogram        |                              |                      |                |                  |
| 6.09                 | Sodium Chloride<br>(Div. 6 Sec. 9)                                    | tonne           |                              |                      |                |                  |
| 6.10                 | Winter Sand<br>(Div. 6 Sec. 10)                                       | tonne           |                              |                      |                |                  |
| 7.01.01              | Straw Barriers<br>(Div. 7 Sec. 1)                                     | metre           |                              |                      |                |                  |
| CARRIED FORWARD \$   |                                                                       |                 |                              |                      |                |                  |

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| TENDER NO. PROJECT NO.                                                       |                 |                              |                      |                |                  |
|------------------------------------------------------------------------------|-----------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A)                                                         | Unit<br>(B)     | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                                                                              |                 |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$                                                           |                 |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.01.02 Silt Fence Barriers<br>(Div. 7 Sec. 1)                               | metre           |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.01.03 Berm Barriers<br>(Div. 7 Sec. 1)                                     | metre           |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.01.04 Sand Bag Barriers<br>(Div. 7 Sec. 1)                                 | metre           |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.01.05 Supply & Install Straw/Hay<br>Bales (Div. 7 Sec. 1)<br>(Spec. Prov.) | each            |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.02.01 Straw Bale Flow Checks<br>(Div. 7 Sec. 2)                            | metre           |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.02.02 Sand Bag Flow Checks<br>(Div. 7 Sec. 2)                              | metre           |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.02.03 Rock Flow Checks<br>(Div. 7 Sec. 2)                                  | metre           |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.03 Settlement Ponds<br>(Div. 7 Sec. 3)                                     | cubic<br>metre  |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| 7.05.01 Hydroseeding Type "A"<br>(Div. 7 Sec. 5)                             | square<br>metre |                              |                      |                |                  |
|                                                                              |                 |                              |                      |                |                  |
| CARRIED FORWARD \$                                                           |                 |                              |                      |                |                  |

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TENDER NO. PROJECT NO.

| Specification<br>(A) |                                                            | Unit<br>(B)     | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|----------------------|------------------------------------------------------------|-----------------|------------------------------|----------------------|----------------|------------------|
|                      |                                                            |                 |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$   |                                                            |                 |                              |                      |                |                  |
| 7.05.02              | Hydroseeding Type "B"<br>(Div. 7 Sec. 5)                   | square<br>metre |                              |                      |                |                  |
| 7.06.01              | Mulching Type "A"<br>(Div. 7 Sec. 6)                       | square<br>metre |                              |                      |                |                  |
| 7.06.02              | Mulching Type "B"<br>(Div. 7 Sec. 6)                       | square<br>metre |                              |                      |                |                  |
| 7.07.01              | Jute Erosion Control Blanket<br>(Div. 7 Sec. 7)            | square<br>metre |                              |                      |                |                  |
| 7.07.02              | Excelsior Erosion Control<br>Blanket (Div. 7 Sec. 7)       | square<br>metre |                              |                      |                |                  |
| 7.07.03              | Straw Erosion Control<br>Blanket (Div. 7 Sec. 7)           | square<br>metre |                              |                      |                |                  |
| 7.07.04              | Wood Fiber Blanket<br>(Div. 7 Sec. 7)                      | square<br>metre |                              |                      |                |                  |
| 7.08                 | Top Soil<br>(Div. 7 Sec. 8)                                | square<br>metre |                              |                      |                |                  |
| 7.09                 | Water Control for Bridge<br>Foundations<br>(Div. 7 Sec. 9) | lump sum        |                              |                      |                |                  |
| 7.10                 | Turbidity Curtains<br>(Div. 7 Sec. 10)                     | metre           |                              |                      |                |                  |
| CARRIED FORWARD \$   |                                                            |                 |                              |                      |                |                  |

Note ! Column "D" to be completed in written form. Column "E" to be completed in numerical form  
 . Column "F" to be completed in numerical form.

WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN

|                      |                                                                             | TENDER NO.                   |                      | PROJECT NO.    |                  |
|----------------------|-----------------------------------------------------------------------------|------------------------------|----------------------|----------------|------------------|
| Specification<br>(A) | Unit<br>(B)                                                                 | Estimated<br>Quantity<br>(C) | Unit Price           |                | Extension<br>(F) |
|                      |                                                                             |                              | Written Words<br>(D) | Figures<br>(E) |                  |
| BROUGHT FORWARD \$   |                                                                             |                              |                      |                |                  |
|                      |                                                                             |                              |                      |                |                  |
| 7.11                 | Water Control at Culvert<br>Extensions or Installations<br>(Div. 7 Sec. 11) | lump sum                     |                      |                |                  |
| 7.12                 | Dewatering with Filter Bags<br>(Div. 7 Sec. 12)                             | lump sum                     |                      |                |                  |
| 7.13                 | Sodding<br>(Div. 7 Sec. 13)                                                 | square<br>metre              |                      |                |                  |
| 7.14                 | Lime<br>(Div. 7 Sec. 14)                                                    | tonne                        |                      |                |                  |

CARRIED FORWARD \$

Note ! Column "D" to be completed in written form. Column "E" to be completed in numerical form.  
 . Column "F" to be completed in numerical form.

WHERE THERE IS A CONFLICT WRITTEN WORD WILL GOVERN





Nova Scotia  
Department of  
Transportation  
and Public Works

## ACKNOWLEDGEMENT OF TENDER CONTENT FORM

List of Definition of Terms, Department of Transportation and Public Works Standard Specification dated February 1, 1997 and the attached Tenders and Special Provisions, referred to in Paragraph 10 of Agreement

dated .....

BETWEEN

.....  
CONTRACTOR

and her Majesty the Queen, in the Right of Her Province of Nova Scotia as represented in this behalf by the Honourable Minister of Transportation and Public Works.

| DESIGNATION            | NAME                                | DATE             |
|------------------------|-------------------------------------|------------------|
| Division 1. Section 1  | Definition of Terms                 | February 1, 2000 |
| Division 1. Section 2  | Instructions to Bidders             | February 1, 2000 |
| Division 1. Section 3  | Agreement                           | February 1, 2000 |
| Division 1. Section 4  | General Provisions                  | February 1, 2000 |
| Division 1. Section 5  | Environmental Protection            | February 1, 1997 |
| Division 2. Section 1  | Clearing                            | February 1, 1997 |
| Division 2. Section 2  | Grubbing                            | February 1, 2000 |
| Division 2. Section 3  | Roadway and Drainage Excavation     | February 1, 2000 |
| Division 2. Section 4  | Disposal of Surplus Material        | March 1, 1998    |
| Division 2. Section 5  | Borrow                              | February 1, 2000 |
| Division 2. Section 6  | Subgrade                            | March 1, 1998    |
| Division 2. Section 7  | Shoulders                           | February 1, 1999 |
| Division 2. Section 8  | Compaction                          | February 1, 1997 |
| Division 2. Section 9  | Water for Compaction & Dust Control | February 1, 1999 |
| Division 2. Section 10 | Rough Grading                       | February 1, 1999 |
| Division 2. Section 11 | Fine Grading                        | February 1, 1999 |
| Division 2. Section 12 | Foundation Excavation               | March 1, 1998    |
| Division 2. Section 13 | Foundation Excavation for Bridges   | March 1, 1998    |
| Division 3. Section 1  | Gravel Borrow                       | February 1, 1997 |
| Division 3. Section 2  | Gravel Type 1, 1S, 2                | February 1, 1999 |
| Division 3. Section 3  | Iron-Blast Furnace Slag             | February 1, 1997 |
| Division 3. Section 4  | Clear Stone                         | March 1, 1998    |

| DESIGNATION            | NAME                                                      | DATE             |
|------------------------|-----------------------------------------------------------|------------------|
| Division 3. Section 5  | Compaction of Gravels                                     | February 1, 1997 |
| Division 3. Section 6  | Loose Laid Rip-Rap                                        | February 1, 1997 |
| Division 3. Section 7  | Hand Laid Rip-Rap                                         | February 1, 1997 |
| Division 3. Section 8  | Armour Rock                                               | February 1, 1997 |
| Division 3. Section 9  | Rock Fill                                                 | February 1, 1997 |
| Division 3. Section 10 | Fill Against Structure                                    | March 1, 1998    |
| Division 3. Section 11 | Unshrinkable Backfill                                     | February 1, 1997 |
| Division 4. Section 1  | Emulsified Asphalt                                        | February 1, 1999 |
| Division 4. Section 2  | Asphalt Cement                                            | February 1, 1997 |
| Division 4. Section 3  | Asphalt Concrete Curbs & Gutters                          | February 1, 1997 |
| Division 4. Section 4  | Asphalt Concrete Hot Mix-Hot Placed                       | February 1, 2000 |
| Division 4. Section 5  | Liquid Asphalt Primer                                     | February 1, 1997 |
| Division 4. Section 6  | Removal of Asphalt Concrete                               | February 1, 1997 |
| Division 4. Section 7  | Asphalt Concrete Patching                                 | February 1, 1997 |
| Division 4. Section 8  | Asphalt Concrete Paving of Bridge Decks                   | February 1, 1997 |
| Division 4. Section 9  | Graded Aggregate Seal (Two Courses)                       | February 1, 1997 |
| Division 4. Section 10 | Graded Aggregate Seal (One Course)                        | February 1, 1997 |
| Division 4. Section 11 | Crack Filling and Crack Sealing - (EPWS)                  | February 1, 1997 |
| Division 4. Section 12 | Seal Coat - (EPWS)                                        | February 1, 1997 |
| Division 4. Section 13 | Reclaimed Asphalt Concrete                                | February 1, 1997 |
| Division 4. Section 14 | Sand Seal Surface Treatment                               | February 1, 1997 |
| Division 4. Section 15 | Cold Mix for Winter Patching                              | February 1, 2000 |
| Division 4. Section 16 | Micro-surfacing - (EPWS)                                  | February 1, 2000 |
| Division 4. Section 17 | Concrete Pavement                                         | February 1, 1997 |
| Division 4. Section 18 | Roller Compacted Concrete                                 | March 1, 1998    |
| Division 5. Section 1  | Piles                                                     | February 1, 1997 |
| Division 5. Section 2  | Timber Structures                                         | February 1, 1997 |
| Division 5. Section 3  | Structural Steel                                          | February 1, 1997 |
| Division 5. Section 4  | Miscellaneous Metal                                       | February 1, 1997 |
| Division 5. Section 5  | Reinforcing Steel                                         | March 1, 1998    |
| Division 5. Section 6  | Steel Guard Rail Systems and Wooden Guide Posts           | February 1, 1997 |
| Division 5. Section 7  | Cast In Place Concrete                                    | March 1, 1998    |
| Division 5. Section 8  | Precast, Prestressed Concrete Girders                     | February 1, 1997 |
| Division 5. Section 9  | Waterproofing Concrete Bridge Decks                       | February 1, 1997 |
| Division 5. Section 10 | Structural Plate Pipe                                     | February 1, 1997 |
| Division 5. Section 11 | Aluminum Guardrail                                        | February 1, 1997 |
| Division 5. Section 12 | Underground Drainage Systems                              | February 1, 1997 |
| Division 5. Section 13 | Concrete Restoration                                      | February 1, 2000 |
| Division 5. Section 14 | Inextensible Mechanical Stabilized Earth (MSE) Structures | March 1, 1998    |
| Division 5. Section 15 | Asphaltic Plug Joints                                     | February 1, 2000 |
| Division 6. Section 1  | Traffic Control Persons                                   | February 1, 1997 |
| Division 6. Section 2  | Flashing Light Units                                      | February 1, 1997 |
| Division 6. Section 3  | Chain Link Fence                                          | February 1, 1997 |

| DESIGNATION            | NAME                                                 | DATE             |
|------------------------|------------------------------------------------------|------------------|
| Division 6. Section 4  | Right-Of-Way-Fence                                   | February 1, 1997 |
| Division 6. Section 5  | Removal of Existing Sidewalks, Driveways and Curbs   | February 1, 1997 |
| Division 6. Section 6  | Supply and Application of Non-Coning Traffic Paint   | February 1, 1997 |
| Division 6. Section 7  | Calcium Chloride Water Solution                      | February 1, 1997 |
| Division 6. Section 8  | Calcium Chloride                                     | February 1, 1997 |
| Division 6. Section 9  | Sodium Chloride                                      | February 1, 1997 |
| Division 6. Section 10 | Winter Sand                                          | February 1, 1999 |
| Division 7. Section 1  | Sediment Barriers                                    | February 1, 1997 |
| Division 7. Section 2  | Flow Checks                                          | February 1, 2000 |
| Division 7. Section 3  | Settlement Ponds                                     | February 1, 2000 |
| Division 7. Section 4  | Maintenance and Sediment Control                     | February 1, 1997 |
| Division 7. Section 5  | Hydroseeding                                         | February 1, 2000 |
| Division 7. Section 6  | Mulching                                             | February 1, 1997 |
| Division 7. Section 7  | Erosion Control Blankets                             | February 1, 2000 |
| Division 7. Section 8  | Topsoil                                              | February 1, 1997 |
| Division 7. Section 9  | Water Control for Bridge Foundations                 | February 1, 1997 |
| Division 7. Section 10 | Turbidity Curtain                                    | February 1, 2000 |
| Division 7. Section 11 | Water Control at Culvert Extensions or Installations | February 1, 1997 |
| Division 7. Section 12 | Dewatering With Filter Bags                          | February 1, 1997 |
| Division 7. Section 13 | Sodding                                              | February 1, 1997 |
| Division 7. Section 14 | Lime                                                 | February 1, 2000 |

The undersigned bidder hereby declares that the Special Provisions and the Province of Nova Scotia Department of Transportation and Public Works Standard Specification's dated March 1, 1998 relating to this contract and listed above have been carefully read and understood. It is mutually agreed that submission of a bid shall be considered prima facie evidence that the bidder has made such examination and is satisfied as to the conditions of the Standard Specification, Special Provisions and Contract.

IN WITNESS WHEREOF the Parties hereto have herewith caused These Presents to be signed and sealed on the day and year first above written.

SIGNED, SEALED AND DELIVERED  
by the Contractor

\_\_\_\_\_  
CONTRACTOR

in the Presence of \_\_\_\_\_  
WITNESS

Revised February 1, 1999



Nova Scotia  
Department of  
Transportation  
and Public Works

### RELEASE OF SECURITY DEPOSIT FORM AFFIDAVIT OF PAYMENT

I, \_\_\_\_\_ of \_\_\_\_\_, in  
(Contractor) (Location)

the Province of \_\_\_\_\_, make oath and say as follows:

1. That I am the \_\_\_\_\_ of \_\_\_\_\_, the  
(Office Held) (Company Name)  
contractor in Project Number 98- XXX between the Department of Transportation and Public Works for the Province of Nova  
Scotia and \_\_\_\_\_.  
(Company Name)
2. That all subcontractors and suppliers who have done work for and supplied materials for Project Number 98-XXX have  
completed their work and supplied all materials they have agreed to supply.
3. That all subcontractors and suppliers for Project Number 98-XXX have submitted invoices for and have been paid for the work  
performed by and the materials supplied by them.
4. That there are no outstanding claims by subcontractors and suppliers relating to Project Number 98-XXX.

BORN BEFORE ME AT \_\_\_\_\_  
(Location)

in the County of \_\_\_\_\_

and the Province of \_\_\_\_\_

this \_\_\_\_\_ day of \_\_\_\_\_, A.D., 19\_\_.

\_\_\_\_\_  
(Signature of Notary Public, Commissioner of  
the Supreme Court of N.S., etc.)

\_\_\_\_\_  
(Contractors Signature)

By my/our signature hereunder I/we hereby identify this as the  
Release of Security Deposit Form referred to in this Contract  
executed by me/us and bearing

dated the ..... day of

.....A.D., 19....

.....  
(Contractor Signature)

**STATEMENT OF ASPHALT CEMENT - LIQUID, ASPHALT - PRIMER  
& EMULSIFIED ASPHALT - TACK**

TO THE DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS  
HALIFAX, NOVA SCOTIA

Bidder:

As a supplement to my/our Tender: **PROJECT NO. 98-XXX TENDER NO. xxxxxxxx**  
**SECTIONS, KILOMETRES**

I/We herewith submit the following statement of my/our source of asphalt cement, primer and emulsified asphalt, which will enable me/us to prosecute and complete the work satisfactorily if awarded the project.

**ASPHALT CEMENT**

\_\_\_\_\_  
(REFINERY NAME)

\_\_\_\_\_  
(LOCATION)

\_\_\_\_\_  
PRICE QUOTATION FROM SUPPLIER  
(Price \$/Metric Tonne)

\_\_\_\_\_  
SPECIFIED TIME OF COMPLETION

**PRIMER**

\_\_\_\_\_  
(REFINERY NAME)

\_\_\_\_\_  
(LOCATION)

\_\_\_\_\_  
PRICE QUOTATION FROM SUPPLIER  
(Price \$/Litre)

\_\_\_\_\_  
SPECIFIED TIME OF COMPLETION

**EMULSIFIED ASPHALT - TACK**

\_\_\_\_\_  
(SUPPLIER)

\_\_\_\_\_  
(LOCATION)

Respectfully submitted,

\_\_\_\_\_  
\_\_\_\_\_  
(ATTACHED WRITTEN PRICE QUOTATIONS FROM SUPPLIER)



RELEASE FROM ALL LIABILITIES

## CONTRACT

KNOW ALL MEN BY THESE PRESENTS that I/we.....  
 .....of.....in the County of ..... doing business  
 under the firm name or style of.....

for and in consideration of the sum of one dollar (\$1.00) of lawful money of Canada to me/us in hand well and truly paid by Her Majesty the Queen in right of her Province of Nova Scotia at or before the ensealing and delivery of These Presents, the receipt whereof is hereby acknowledged, have released and forever discharged and by These Presents do release and forever discharge Her Majesty The Queen in right of Her Province of Nova Scotia of and from all actions, causes of action, suits, debts, forfeitures, damages, claims and demands whatsoever

in law or in equity which I/we the said.....

ever had, now have, or hereafter can, shall or might have by reason of or arising out of a certain contract or agreement respecting the.....

the County of \_\_\_\_\_, dated the \_\_\_\_\_.

day of..... A. D., 19....., Between.....

in the County of....., Province of Nova Scotia and HER MAJESTY THE QUEEN, in the right of Her Province of Nova Scotia as represented in this behalf by the HONOURABLE..... MINISTER OF TRANSPORTATION AND PUBLIC WORKS of the Province of Nova Scotia, or by reason of or arising out of any breaches or breaches thereof, or by reason of or arising out of any work or labour or services performed, material supplied, or plant or machinery used in connection with the said construction by me/us,

the.....

whether under the said contract or otherwise.

IN WITNESS WHEREOF I/we, the said.....

.....have hereunto my/our hand and seal subscribed and set at the City of Halifax,  
the.....day of.....A. D., 19.....

Signed, Sealed and  
Delivered in the  
presence of,

.....  
Witness

.....  
Contractor

Signature not to be affixed here until after fulfillment of  
Contract.

By my/our signature hereunder I/we hereby identify  
this as the Release Form referred to in this  
Contract executed by me/us and bearing date

the.....day of.....

A.D., 19.....

.....  
Contractor.

Nova Scotia Department of  
Transportation and Public Works  
Halifax, N.S.

March 1, 1998

**ENGINEER'S CERTIFICATE OF FINAL ESTIMATE**

**TO:** The Honorable Minister of Transportation and Public Works of Nova Scotia

**RE:** Agreement made the \_\_\_\_\_ day of \_\_\_\_\_ by and between the Department of Transportation and Public Works

and \_\_\_\_\_ (Contractor) covering the following:

Contract: \_\_\_\_\_ sections in \_\_\_\_\_ County.

Section 1:

Section 2:

I hereby certify that the above noted contract has been inspected on behalf of the **Engineer** and it was found that the Contractor has completed **the work** and therefore, recommend to the Minister that the final estimate be paid to \_\_\_\_\_ in accordance with the terms of the contract.



(Contractor)

The only known recoverables are as outlined in the letter attached, dated \_\_\_\_\_, 19\_\_\_\_ and signed by \_\_\_\_\_ Project Engineer.

CERTIFICATE DATED \_\_\_\_\_, 19\_\_\_\_

SIGNATURE \_\_\_\_\_

**District Director**

CC: Contractor \_\_\_\_\_



NOVA SCOTIA  
DEPARTMENT OF  
TRANSPORTATION  
AND PUBLIC WORKS

### Modification of Tender

Please be advised that the following changes are requested as per

Project Number \_\_\_\_\_

Tender Number \_\_\_\_\_

Date \_\_\_\_\_

| Sect.<br>No.              | Item<br>No. | Item Description | Quantity<br>(from Tender<br>Document) | Unit Price Change |          | Extension<br>(Quantity x<br>Increase/Decrease) |
|---------------------------|-------------|------------------|---------------------------------------|-------------------|----------|------------------------------------------------|
|                           |             |                  |                                       | Increase          | Decrease |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
|                           |             |                  |                                       |                   |          |                                                |
| Total Extended Difference |             |                  |                                       |                   |          |                                                |

As indicated above I/we wish to change my/our tender price by the following

amount \$ \_\_\_\_\_  
(NUMERALS)

\_\_\_\_\_  
(WRITTEN WORDS)

\_\_\_\_\_  
Contractors Signature

\_\_\_\_\_  
Company or Contractor's Name

NSCSA  
NSCSA  
NSCSA  
NSCSA  
NSCSA  
NSCSA  
NSCSA  
NSCSA  
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NSCSA  
NSCSA  
NSCSA  
NSCSA

# Construction Safety Certification

This certificate recognizes that:

*Sample*

In keeping with the principles of Partnerships has, as of this date:

- developed and implemented a health and safety program and,
- met the standard of Partnerships through an independent evaluation of their health and safety program.

Nova Scotia Construction Safety Association  
Partner in Health and Safety



Executive Director  
Occupational Health and Safety Division



Date: \_\_\_\_\_

Certificate No. \_\_\_\_\_





## Nova Scotia Construction Safety Association

35 MacDonald Avenue Dartmouth, Nova Scotia B3B 1C6

### Letter of Good Standing Certificate of Recognition Program

**Issued To:**

Based upon the fact that  
is an active participant in the Certificate of Recognition Program, the Nova Scotia Construction  
Safety Association hereby issues a letter of good standing:

**Date of Issue:**

**Expiry Date:**

Sample

This letter of good standing is issued to a firm actively participating in NSCSA programs and  
whose current standing falls into the category noted below:

**Certificate of Recognition** ☐

**Audit Pending** ☐

**In the Process** ☐

\* See reverse for category definitions

**Conditions:**

**NSCSA Representative:** \_\_\_\_\_

## Definitions

### Certificate Of Recognition

The Certificate of Recognition is awarded to firms who have completed the training requirements, fully implemented a loss control program, and successfully participated in the Audit process. This certificate is valid for a period of one year.

### Audit Pending

Upon receipt of a successful internal audit, and review of same by the NSCSA, an audit date or time period will be set by Audit Services. Firms who have completed this process will be considered Audit Pending.

### In The Process

Firms or individuals who have completed the COR courses (PLC, Leadership, PLC Audit and Safety Orientation) and have met their training obligations as outlined by the Occupational Health and Safety Act, are considered to be "In The Process".



PROPOSED

NOVA SCOTIA REGULATION 1981

UNDER THE ENVIRONMENTAL PROTECTION ACT, 1973

ASPHALT PAVING PLANT REGULATION

## Section A

1. This Regulation will be known as the "Asphalt Paving Plant Regulation," issued under the Environmental Protection Act, Chapter 6 Statutes of Nova Scotia, 1973.
2. In this Regulation:
  - (a) "Minister" means Minister of the Environment;
  - (b) "Act" means the Nova Scotia Environmental Protection Act;
  - (c) "Asphalt Paving Plant" means a plant or any part thereof in which asphalt concrete is produced by heating and drying aggregate and mixing with asphalt cement;
  - (d) "Aggregate Material" means any material or materials including, but not limited to, gravel, slag, limestone, crushed rock, sand, or any combination of such materials used to produce asphalt paving when mixed with bituminous asphalt;
  - (e) "Permanent Asphalt Paving Plant" means an asphalt paving plant which remains in one location more than two (2) construction seasons;
  - (f) "Portable Asphalt Paving Plant" means an asphalt paving plant which does not remain in one location more than two (2) construction seasons;
  - (g) "Application" means an application for approval and/or permit of authorization for an asphalt paving plant made under Section 23 of the Environmental Protection Act;
  - (h) "Liquid Effluent" includes treatment pond effluent or treatment facility seepage, but does not include storm water runoff;
  - (i) "Particulate Matter" means any finely-divided liquid or solid material other than water droplets;
  - (j) "Operation Area" includes all the land and works that are used, or have been used by past or present activities and, without limiting the generality of the foregoing; includes open pits, buildings, stockpile area, active and abandoned waste, rock dumps, treatment ponds, cleared or disturbed areas adjacent to the above segments of the operation, ditches and portions of watercourses or water bodies whose character has been altered by activity;
  - (k) "Standard Condition" means twenty-five degrees celsius (25°C), and at an atmospheric pressure of seven hundred and sixty (760) millimetres of mercury;
  - (l) "Undiluted Exhaust Gas" means any gas or combination of gases that are released or discharged into the air and that are not or have not been diluted by the artificial addition of air from any source;
  - (m) "Stack Test" means the measurement of particulate emissions as set down in Environment Canada's Report EPS 1-AP-74-1. Standard Reference Methods for Source Testing: Measurement of Emissions of Particulate from Stationary Sources."



## Section B

### 1. Application for Permit or Approval

Anyone who applies for a permit and/or approval of an asphalt paving plant under Section 23 of the Environmental Protection Act must furnish the following information and documents.

- (a) a topographic map indicating location of plant and affected watercourses;
- (b) a survey plan or certified plot plan of the area indicating:
  - (i) the projected site for the asphalt paving plant, property boundaries and ownership\*, storage and handling of aggregate materials, and location of settling ponds and watercourses indicating from where water is to be withdrawn;
  - (ii) the layout of public highways, access roads, watercourses, wells, houses, and any other development within a radius of 1200 feet or 350 metres from the asphalt paving plant;

\*Written permission of adjacent landowners must accompany this application if any part of the asphalt plant facilities are to be located on or within the required minimum separation distances from adjacent properties.

- (c) make, model number, plans and specifications of asphalt paving plant and equipment, including any devices designed to abate or eliminate the emission, deposit, issuance of discharge of contaminants into the environment;
- (d) a report describing the operating conditions, the operation of equipment and machinery, type of fuel used, the volume of production in tons per hour, and the methods of eliminating wastes and residue;
- (e) a calculation of particulate matter emitted into the atmosphere in micrograms per cubic meter;
- (f) the plans and specifications of the water supply and wastewater disposal equipment, and an approved Water Rights Application must be received from the Nova Scotia Department of the Environment.

## Section C

### 1. Minimum Separation Distances:

- (a) The asphalt paving plant and the loading, unloading and discharge areas of aggregate stockpiles shall be situated at distances to be specified, but in no case less than the following:
  - (i) 1200 feet from any territory zoned for residential, commercial, parks or recreational use;
  - (ii) 300 feet from any residence property boundary;
  - (iii) 100 feet from any other property boundary;

- (iv) 100 feet from any surface watercourse;
- (v) 100 feet from the road allowance of any common and public highway.
- (b) Settling ponds shall be situated at a distance to be specified, but in no case less than the following:
  - (i) 100 feet from any surface watercourse;
  - (ii) 300 feet from any source of domestic water supply;
  - (iii) 100 feet from any property boundary.

#### Section D

##### 1. Water Effluent:

- (a) all industrial process water shall be arranged in closed circuit;
- (b) settling ponds designed to control and treat surface runoff shall have a minimum volume of forty (40) cubic metres per one thousand (1000) square metres (0.125 acre - feet/acre) of disturbed area draining to the ponds;
- (c) all storm runoff from the operating site shall be collected and treated to meet the following suspended solids concentrations prior to discharge outside the property boundaries or to any watercourse:
  - (i) maximum suspended solids concentration in any grab sample - 100 mg/l;
  - (ii) maximum arithmetic monthly average of at least four tests for suspended solids concentration - 50 mg/l.

##### 2. Air Emissions:

- (a) sources of fugitive emissions should leave via the stack. These sources may include but are not limited to, hot screen, bucket elevators, weigh hoppers and mixing bins;
- (b) no person shall operate or permit the operation of an asphalt paving plant from which emissions are released or discharged if that asphalt paving plant emits or can emit particulate matter in excess of 500 milligrams per cubic metre of dry, undiluted exhaust gas at standard conditions;
- (c) if the Minister has reasons to believe that an asphalt paving plant is in violation of this regulation, he may require that an emission test be conducted to determine plant emissions. The undertaking and cost of this test will be the responsibility of the owner or operator of the asphalt paving plant, and such test will be done by a person or persons acceptable to the Department.

### Section E

#### 1. Area Maintenance:

- (a) aggregate stockpiles and access roads shall be situated and controlled such that a dust problem does not occur;
- (b) rejected fine material and waste asphalt must be disposed of in a manner approved by the Department before commencement of operation of the plant;
- (c) the area disturbed during the operation of the plant will be rehabilitated to the satisfaction of the Nova Scotia Department of the Environment.

### Section F

#### 1. Noise:

No person shall operate or permit the operation of an asphalt paving plant which is responsible for causing sound levels in areas outside the operations area where people live, work, or take part in recreation to exceed any of the following:

An Leq of 65 dBA between the hours of 0:700 to 19:00 hours

An Leq of 60 dBA between the hours of 19:00 to 23:00 hours

An Leq of 55 dBA between the hours of 23:00 to 0:700 hours.

Leq is the energy equivalent continuous sound pressure level expressed by the equation

$$Leq = 10 \frac{1}{T} \int_0^T \frac{SPL}{10} dt$$

Nova Scotia Department of  
Transportation and Communications  
Halifax, Nova Scotia

March 1, 1994



NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT

PIT & QUARRY GUIDELINES

*PREPARED BY*

INDUSTRIAL & AIR QUALITY BRANCH

Revised May 1, 1988



- 2 -

**DEFINITIONS**

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Active Area</b>      | For the purpose of performance bonding, active area shall be considered the area required to operate a pit or quarry. This would include the site "working face" and locations where topsoil, overburden and bedrock are disturbed. All buildings, structures, processing facilities, pollution abatement systems (i.e. settling ponds) and product stockpiles located on the pit or quarry property shall be considered active area. |
| <b>Disturbed Area</b>   | Any area on a pit or quarry site that has been stripped of vegetation and is susceptible to erosion.                                                                                                                                                                                                                                                                                                                                  |
| <b>Liquid Effluents</b> | Storm run-off, wash water, or any other liquid waste.                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Minister</b>         | The Honourable Minister of the Environment for the Province of Nova Scotia.                                                                                                                                                                                                                                                                                                                                                           |
| <b>Perched Pond</b>     | A pond, resulting from a pit or quarry excavation which is above the natural water table and is in excess of one half (0.5) metre (20 inches) in depth and covers a minimum area of one thousand (1000) square metres (10,800 square feet).                                                                                                                                                                                           |
| <b>Permanent</b>        | An operation that continues for a period of time in excess of two (2) consecutive construction seasons.                                                                                                                                                                                                                                                                                                                               |
| <b>Pit</b>              | An excavation made for the purpose of removing unconsolidated earth, sand or gravel from the environment.                                                                                                                                                                                                                                                                                                                             |
| <b>Quarry</b>           | An excavation, requiring the use of explosives, made for the purpose of removing consolidated rock from the environment.                                                                                                                                                                                                                                                                                                              |
| <b>Rehabilitate</b>     | Grade a disturbed area to agreed contours and stabilize the area so graded with a permanent vegetative cover.                                                                                                                                                                                                                                                                                                                         |
| <b>Scrap</b>            | All waste material including rejected metal, lumber, and tree stumps.                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Temporary</b>        | An operation that does not continue for a period of time in excess of two (2) consecutive construction seasons.                                                                                                                                                                                                                                                                                                                       |
| <b>Watercourse</b>      | The bed and shore of every river, stream, lake, creek, pond, spring, lagoon, swamp, marsh, wetland, ravine, gulch or other natural body of water, and the water therein, including groundwater, within the jurisdiction of the Province, whether it contains water or not.                                                                                                                                                            |

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**I. Minimum Separation Distances:**

- (1) (a) No building, structure, plant or product stockpile (including topsoil and overburden stockpiled for rehabilitation purposes) shall be located within:

(i) Thirty (30) metres (100 feet) of the boundary of the pit or quarry property;

or

(ii) In the case of pit operations, ninety (90) metres (300 feet) of the boundary of any abutting property in or restricted to residential use.\*

\* (or less with the written permission of adjacent land owners).

- (2) No pit or quarry excavation shall be closer than:

(a) Thirty (30) metres (100 feet) from the road allowance of any common and public highway.

(b) In case of pit operations, ninety (90) metres (300 feet) from abutting property in or restricted to residential use.\*

(c) In the case of a quarry operation, eight hundred (800) metres (0.5 mile) from any property in or restricted to residential use.\*

(d) Fifteen (15) metres (50 feet) from any other property boundary.\*

\* (or less with the written permission of adjacent land owners).

- (3) A minimum distance of thirty (30) metres (100 feet) shall be maintained between the boundaries of the excavation or associated works and the bank top or high water mark of any surface watercourse. (See Attached Drawing)

**II. Rehabilitation:**

- (1) Every operator of a permanent pit or quarry shall while the pit or quarry is in operation, progressively rehabilitate the pit or quarry to the final grade and contours indicated on the site plan.

- (2) Where pits and quarries are to be operated on a seasonal or intermittent basis the site shall be rehabilitated prior to each temporary abandonment.

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- (3) Except in the case of a pit or quarry when the final slopes shall be those slopes indicated on an approved site plan, every final excavation face of a pit or quarry shall not exceed a slope of one to one (1:1) (horizontal:vertical).
- (4) Every pit excavation made to a water producing depth shall have all banks sloped to the water line at a slope which shall not exceed one and one-half to one (1.5:1) (horizontal:vertical).
- (5)
  - (a) Every operator of a pit or quarry shall stockpile existing topsoil, stripping, fill or waste rock to facilitate rehabilitation of the pit or quarry.
  - (b) Every stockpile referred to in subsection (a) shall have stable slopes so as to prevent erosion.
- (6) Existing topsoil in sufficient quantity and depth to raise and maintain a healthy growth of vegetation adequate to bind the soil and prevent erosion shall be replaced in excavated areas and in any other areas indicated on the site plan. The areas so covered shall be planted with legumes and/or grasses plus trees and/or scrubs if desired.
- (7) A pit or quarry may be rehabilitated by backfilling.
- (8)
  - (a) Security in the form of a bond or certified cheque in the amount of five hundred dollars (\$500) per one thousand (1000) square metres (\$2000/acre) shall be posted to ensure site rehabilitation to the satisfaction of the Nova Scotia Department of the Environment. The bond or certified cheque shall be made payable to the Province of Nova Scotia and shall be submitted to the Department of the Environment.\*
  - \* The total pit or quarry land area requiring performance bonding is termed the "active area". Please refer to page number (1) for a definition of this term.
  - (b) In the case of temporary pits or quarries established solely for the purpose of satisfying contractual agreements with the Nova Scotia Department of Transportation the Security requirement is satisfied by the usual hold-back of money by the Department of Transportation.
- (9) The security deposit referred to in Section (8) Subsection (a) shall be released upon request by the applicant and only after completion of rehabilitation to the satisfaction of the Minister.

### III. Discharge of Silt and Contaminated Run-Off:

- (1) All storm run-off from the operating site and all liquid effluents resulting from the

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operation shall be collected and treated to meet the following suspended solids concentrations prior to discharge outside the property boundaries or to any watercourse:

- (a) Maximum suspended solids concentration in any grab sample - 70 mg/l;
  - (b) Maximum arithmetic monthly average suspended solids concentration - 35 mg/l;
- (2) All wash water systems shall be arranged in closed circuit.
  - (3) Where settling ponds are used to reduce suspended solids concentrations in either storm run-off or process water, the ponds shall be cleaned at or before sixty (60) percent of the capacity of any pond is occupied by settled material. A permanent measuring gauge, in the form of a graduated pole, shall be installed in each pond to facilitate volume estimations.
  - (4) Settling ponds designed to control and treat surface run-off shall have a minimum volume of forty (40) cubic metres per one thousand (1000) square metres (0.125 acre-feet/acre) of disturbed area draining to the ponds.
  - (5) Settled material cleaned from the ponds shall be evenly spread over worked out portions of the excavated area, to a depth which will support vegetative growth, the areas so covered shall be stabilized by establishing a permanent vegetative cover.
  - (6) All waste oils shall be collected in metal drums and disposed of through the services of a waste oil company.

#### IV. Dust Emissions:

Measurement of dust emissions at source is impractical due to the large surface area involved, therefore, it is recommended that we adopt the Clean Air Ambient Air Quality Objectives for suspended particulate matter as follows:

| <u>Parameter</u>             | <u>Acceptable</u>                                                                 | <u>Desirable</u>                                       |
|------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------|
| Suspended Particulate Matter | (a) 60-70 $\mu\text{g}/\text{m}^3$<br>annual geometric mean                       | 0-60 $\mu\text{g}/\text{m}^3$<br>annual geometric mean |
|                              | (b) 0-120 $\mu\text{g}/\text{m}^3$<br>average concentration over a 24 hour period |                                                        |

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**Notes:**

- (1) Suspended Particulate Matter shall be measured by the High Volume Method as described in Report No. E.P.S. 1-AP-73-2.
- (2) Monitoring stations shall be located on the property line of the site being monitored, or at other locations as directed by the Minister.

**V. Sound Level Limits:**

The following sound level limits shall be observed at the property boundaries of the proposed site:

**Leq. Sound Level Limits \***

| "Night"  | "Evening"                                            | "Day"  |
|----------|------------------------------------------------------|--------|
| 55 dBA   | 60 dBA                                               | 65 dBA |
| Night:   | 23:00 - 07:00, All Day Sunday and Statutory Holidays |        |
| Evening: | 19:00 - 23:00 Hours                                  |        |
| Day:     | 07:00 - 19:00 Hours                                  |        |

- \* The equivalent sound level is measured in Terms of dBA. The equivalent sound level, then, takes into account the major factors influencing the effect of noise on man, magnitude, frequency range and time variation.

**VI. \* Blasting:**

Concussion (Air Blast) 128 dBA      Within 7m of a building not located on the property where the blasting operations occur.

Ground Vibration 0.5 in./sec.

(12.5 mm/s) Peak Particle Velocity      Measured below grade or less than 1m above grade in any part of a building not located on the property where blasting occurs.

- \* Monitoring results shall be forwarded to the Department on a monthly basis unless otherwise indicated.



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**VII. Protection of Groundwater Resources:**

No excavation shall be below the water table without the written permission of the Minister of the Environment.

**VIII. Safety**

- (1) Every Operator of a pit or quarry shall ensure that all scrap is collected in a specific area.
- (2) All perched ponds shall be drained to the lowest level of the land in the pit or quarry excavation.
- (3) Every operator of a pit or quarry shall secure the boundaries of the pit or quarry. Faces may be secured by reducing the slope of the face to one to one (1:1) (horizontal:vertical) or less, or by fencing.
- (4) Every entrance and exit to or from a pit or quarry shall have a gate which shall be kept closed and locked during the time when the pit or quarry is not in operation.
- (5) Every road entrance and exit to or from a pit or quarry shall be located so as to provide a clear and unobstructed view in both directions onto a common and public highway.
- (6) In the case of quarry operations, signs shall be posted on all adjacent common and public highways, located eight hundred ( 800) metres (0.5 mile) from the operating site, indicating that one is entering a blasting zone.
- (7) Explosives shall not be denoted on Sundays, Holidays\* or between the hours of 6 p.m. and 8 a.m.

\* Holidays: New Year's Day  
Good Friday  
Easter Monday  
Victoria Day  
Canada Day  
Labour Day  
Thanksgiving Day  
Remembrance Day  
Christmas Day  
Boxing Day



Nova Scotia

Department of  
the Environment**NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)****Legal Conditions:****1.0 DEFINITIONS**

- 1.01 "Act" means the *Environment Act*, S.N.S 1994-95, C.1.
- 1.02 "Approval Holder" includes the applicant, authorized heirs, successors and assigns of the Approval Holder.
- 1.03 "Minister" means the Minister of the Environment or person designated an Administrator of Water Approvals.

**2.0 EXTENSION OF TIME**

- 2.01 The time within which the work authorized by this Approval must be completed may, at the option of the Minister, be extended for a prescribed period, subject to any changes in the Terms and Conditions set forth in the Approval and provided the Approval Holder has complied with the Terms and Conditions of the existing Approval.

**3.0 RESERVATIONS/LIMITATIONS**

- 3.01 The Approval Holder may alter the watercourse, or store water in any watercourse as authorized and, without limiting the generality of the foregoing, shall not alter or use the watercourse so as to:
- a) prejudice any riparian rights of any owner or of any person lawfully in possession of or holding any lands abutting the watercourse or any rights therein;
  - b) suffer any loss, damage or nuisance to adjacent or abutting lands.
- 3.02 The Approval Holder shall not at any time or for any purpose place a pecuniary value on or claim any pecuniary value for the rights and privileges granted by this Approval, whether considered alone or in conjunction with any other property rights or privileges, over and above the amounts, if any, actually paid to the Minister by the Approval Holder for said rights and privileges.
- 3.03 It is recognized and agreed that this Approval does not give sole or exclusive rights to any watercourse, and the Minister reserves the right to use the watercourse and

water therein for any purpose and to allow others to use the watercourse and water for any purpose, provided that such use or purpose does not constitute a substantial interference with the rights granted to the Approval Holder.

#### 4.0 TERMS AND CONDITIONS

- 4.01 The Approval Holder shall not assign, sell, lease or transfer this Approval without the written consent of the Minister, whose consent will not be unreasonably withheld, and any assignment or transfer shall be subject to such Terms and Conditions as the Minister may impose.
- 4.02 The Approval Holder shall comply with all municipal, provincial and federal laws and regulations including but not limited to those laws and regulations relating to the environment, fisheries, public health and fire hazards and the *Approvals Procedure Regulations*.
- 4.03 The Approval Holder shall be responsible for obtaining and paying the costs of any and all approvals, services, easements, rights of way and authorizations of any kind necessary for the performance of any activities undertaken pursuant to this Approval. The Minister does not covenant that such approvals, services, easements, rights of way and authorizations of any kind will be issued by the Province of Nova Scotia, any other body or person.
- 4.04 Work undertaken by the Approval Holder shall at all times conform with the Terms and Conditions of the Approval, including the applicable Watercourse Alteration Specifications.
- 4.05 The Approval Holder shall maintain any bridge, culvert, dam, sluice, flume, conduit or other structure built or used in or on the watercourse in a state of good repair and in a clean and tidy condition to the satisfaction of the Minister. The Approval Holder shall conform to any and all directions of the Minister concerning the rehabilitation of a watercourse or the construction, reconstruction, maintenance, removal, operation and location of any bridge, culvert, dam, sluice, flume, conduit or other structure built, used or maintained in and on the watercourse.
- 4.06 The Minister and all persons designated as inspectors pursuant to the *Act* shall have free access at all times to the watercourse, any structure built, operated or maintained in and on the watercourse and to land under control of the Approval Holder associated with the works to ensure that the Terms and Conditions of the Approval are being fulfilled.
- 4.07 The Approval Holder shall indemnify and save harmless the Minister against any loss, cost or damage occasioned by the Approval Holder's relocation of a

watercourse or the construction of, repair, alteration or addition to any culvert,

bridge, dam, sluice, flume, conduit or other structure. Such indemnity shall include, but not be restricted to, all losses, costs or damages occasioned by the improper or faulty relocation of a watercourse or the improper or faulty construction of, repair, alteration or addition to any culvert, bridge, dam, sluice, flume, conduit or other structure in or on the watercourse, or by any trespass, negligence or wilful act of the Approval Holder or any employees, agents, contractors or guests of the Approval Holder.

- 4.08 On the expiry or termination of this Approval or at the end of the useful life of the structure, as determined by the Minister, the Approval Holder shall immediately cease operations and peaceably and quietly yield up and deliver possession of the watercourse in a condition satisfactory to the Minister, and the Minister shall incur no further expense, liability or cost in this regard.
- 4.09 The Approval Holder shall remove any bridge, culvert, dam, sluice, flume, conduit or other structure or remnants thereof, and any equipment or personal property built, used or maintained in and on the watercourse at the end of the useful life of the structure, to the satisfaction of the Minister. In the event the Approval Holder fails to remove such bridge, culvert, dam, sluice, flume, conduit or other structure or remnants thereof and any equipment or personal property, the Minister may, without any attaching liability, remove or demolish the same in whatever manner the Minister deems necessary. The Approval Holder shall pay all expenses and costs of such removal or demolition.
- 4.10 The Minister or any employee, servant or agent of the Department will not be liable for any damage, loss or claim of any kind which may or hereafter arise.

## 5.0 AMENDMENTS

- 5.01 This Approval shall not be changed, modified or discharged orally. Any changes shall be made in writing and, when agreed upon by both parties, shall be incorporated and form part of this Approval.

## 6.0 TERMINATION/SUSPENSION

- 6.01 If at any time during the term of this Approval there be any default, breach or nonobservance by the Approval Holder in respect of any covenant, proviso, or these Terms and Conditions or reservation herein contained, or the Approval Holder has failed to use the watercourse as stipulated in the Approval, the Minister may suspend or terminate the Approval after giving the Approval Holder notice of the breach or default and five business days to remedy the same.



- 6.02 If the Approval Holder assigns or sublets their Approval or any part thereof except as is expressly provided herein, if the contractor becomes bankrupt or insolvent, if a receiver is appointed for any part of the assets of the Approval Holder, if any assignment is made for the benefit of the creditors of the Approval Holder, or if it is wound up or goes into liquidation, the Minister may terminate the Approval.

## 7.0 ENUREMENT

- 7.01 This Approval shall enure to the benefit of and be binding upon the Minister, the Minister's successors, assigns and authorized representatives, and upon the Approval Holder, and the heirs, administrators, executors and assigns of the Approval Holder.

## 8.0 WAIVER

- 8.01 The failure of the Minister to insist upon a strict performance of any covenant, proviso or Terms and Conditions contained in this Approval shall not be deemed a waiver of any rights or remedies that the Minister may have and shall not be deemed a waiver of any subsequent breach or default in the covenants, provisos or Terms and Conditions contained in this Approval.

## 9.0 NOTICE

- 9.01 Any notice or document required to be given by this Approval shall be sufficiently given if delivered or mailed postage prepaid:
- a) to the Minister at the Regional Office of the Department of the Environment, indicated on the Approval, or at such other address as the Minister may direct from time to time.
  - b) to the Approval Holder at the address shown on the front of the Approval.
- 9.02 The Approval Holder shall notify the Minister in writing of any change in the above address.
- 9.03 Any notice or document mailed to the Minister or Approval Holder shall be deemed to have been received five days following the day such notice was posted.

## 10.0 RELEASE OF INFORMATION

- 10.01 Subject to limitations provided in the *Freedom of Information and Protection of Privacy Act*, the Approval Holder consents to the release of the issuance of this Approval to third parties and all reports, monitoring data and other information respecting the Approval.

## 11.0 NEW INFORMATION

- 11.01 An Approval Holder shall forthwith submit to the Minister any new and relevant information respecting any adverse effect that actually results or may potentially result from the activity to which the Approval relates that comes to the attention of the Approval Holder after the issuance of the Approval.

Nova Scotia

Department of  
the Environment**NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)****General Specifications:**

- G1. Copies of all Approvals together with the Terms and Conditions of Approval are to be available on the site at all times during construction. All instream work is to be carried out under low flow conditions and during the period of June 1 to September 30, unless otherwise identified in the Water Approval.
- G2. On-site machinery and potential pollutants are to be stored in an area above the flood water limits.
- G3. Fuel storage and refuelling or lubrication of equipment is only approved in designated areas. These areas are to be located such that accidental pollutant discharge will not enter surface water or domestic water supplies. Under no circumstances will the designated area be within 30 metres (100 feet) of a watercourse or wetland. Note: this clause is not applicable to pile-driving equipment.
- G4. Equipment required to work within a watercourse is to be mechanically sound, having no leaking fuel tanks or hydraulic connections.
- G5. Machinery and equipment (eg., concrete trucks) are not to be washed out within 30 metres (100 feet) of a body of water or in an area where wash water will run into a watercourse.
- G6. All construction debris is to be contained where flood water will not come in contact with the debris until the debris is properly removed from the site.
- G7. No additional watercourse or wetland alteration is to take place unless prior authorization from the Nova Scotia Department of the Environment has been given.
- G8. The Approval Holder must adhere to the Federal Department of Fisheries and Oceans' requirements for fish passage and blasting in or near a watercourse.
- G9. Slates or shales are not to be used without prior written consent from the Nova Scotia Department of the Environment. Immediately notify the assigned Inspector when slates or shales are encountered during any part of construction.

- G10. Silted water is not to be pumped directly into the watercourse. Any water discharged into the watercourse is not to exceed a suspended solids concentration of 50 mg/l on a grab sample or 25 mg/l on monthly arithmetic mean nor turbidity concentration of 15 NTU above upstream levels.
- G11. Unless otherwise noted in writing by the Nova Scotia Department of the Environment, all construction site runoff shall be adequately treated to prevent siltation of watercourses.
- G12. Any upslope sheet runoff or overland flow drainage is to be temporarily diverted away from the construction site. Care is to be taken not to create other drainage problems by this diversion.
- G13. Culverts and erosion control devices are to be installed prior to grubbing and filling of approaches.
- G14. Flow checks, sediment traps or filters are to be constructed and maintained in roadside ditches prior to grubbing.
- G15. Disperse runoff through natural vegetation or through erosion and sediment control devices upon leaving the construction site before it reaches the watercourse.
- G16. Provide settling ponds of suitable size to reduce runoff velocity and to retain runoff long enough to assist in the precipitation of solids. A minimum requirement is that 1/16 acre-ft. of storage be provided for every acre of exposed construction area. Settling ponds are to be cleaned out when they are half full of sediment.
- G17. Where ditches are required for culvert construction, they are to be stabilized following erosion control measures as set out in the Nova Scotia Department of the Environment's "Erosion and Sedimentation Control Handbook for Construction Sites."
- G18. A buffer strip of undisturbed vegetation at least 30 metres (100 feet) wide is to be maintained between the watercourse and construction activity until stream crossing construction is complete. For information on actual water crossings, refer to the applicable specifications.
- G19. Excavation spoils are to be stabilized, immediately upon placement, following measures as shown in the Nova Scotia Department of the Environment's "Erosion and Sedimentation Control Handbook for Construction Sites". At no time are excavation wastes or spoils to be deposited in or on a floodplain.
- G20. Road drainage must not be discharged over a steep cut or fill unless appropriate erosion control measures are in place on the embankment and at the toe. Appropriate measures may include an apron, a diversion dyke, and a discharge pipe extending all the way to the bottom of the embankment.

- G21. Stabilize all potential erosion sites by covering slopes with grass seed, hay or straw mulching as work progresses (not at the end of the project).
- G22. Rock and similar erosion control works are to be constructed of clean, non-erodible, non-ore-bearing and non-toxic materials.



Nova Scotia

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the Environment**NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)****Bank Stabilization**

- BS1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- BS2. Banks are to be graded to a slope not exceeding 2:1 (horizontal:vertical).
- BS3. The material used for bank stabilization works is not to come from the bed of the watercourse and must be clean, durable, non-ore-bearing and non-toxic.
- BS4. Filter fabric or filter material is to be used when necessary beneath or filter material can be incorporated with the riprap to prevent erosion of fine bank material. Geotextile or filter fabric liners may be required for soils comprised of clay.
- BS5. The following uniformly-graded, stone riprap material shall be used as armour for bank stabilization unless alternate materials have been approved by the Nova Scotia Department of the Environment.

**Class 1**

Local velocity up to  
10 feet per second.

At least 70% of the riprap material shall be between  
200mm and 450mm (8 inch - 18 inch).

**Class 2**

Local velocity up to  
13 feet per second.

At least 70% of the riprap material shall be between  
300mm and 760mm (12 inch - 30 inch).

**Class 3**

Local velocity up to  
15 feet per second.

At least 70% of the riprap material shall be between  
500mm and 1200mm (20 inch - 48 inch).

- BS6. Riprap must be placed by an excavator, backhoe, or by hand and carefully fitted along the streambank to prevent scouring and bank failure. All machine work is to be carried out from the watercourse banks unless otherwise stipulated by the Department. No equipment shall be permitted in the watercourse.

- BS7. Riprap is to be installed to minimum thickness of 1.5 times the maximum stone size [minimum thickness 300mm (12 inches)].
- BS8. If riprap is to be placed on the stream bottom, a minimum thickness of 3.0 times the maximum stone size is required [minimum thickness 600mm (24 inches)].
- BS9. Bank stabilization works are to be designed to withstand water forces from buoyancy, high velocity, wave action and ice movement.
- BS10. Vegetation is to be established on surrounding areas not covered by riprap.

Nova Scotia



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the Environment

## **NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)**

### **Beach Enhancement**

- BE1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas. The use of a silt screen (silt curtain) may be required.
- BE2. An approval for beach enhancement structures must be obtained from the Department of Natural Resources prior to any beach enhancement work.
- BE3. Beach enhancement work may not exceed 7.6 metres ( 25 feet) along the shoreline.
- BE4. Rocks and boulders that are not embedded are to be removed manually.  
Specific authorization for the removal of rocks and boulders from a watercourse will be contained in the Water Approval.
- BE5. Machinery is not permitted to enter the watercourse.
- BE6. Excavation of material from the watercourse is not permitted.
- BE7. Sand is not permitted to enter the watercourse. Any areas to be covered with sand are to be above the high water mark.
- BE8. Only a thin layer of gravel that is clean, non-ore-bearing and non-toxic to aquatic life is permitted to be placed in the area of the beach enhancement.
- BE9. Any areas that are exposed, as a result of beach enhancement, are to be stabilized as soon as the work is complete.



Department of  
the Environment

## NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)

### Bridges

The following applies to bridge construction or maintenance:

- B1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- B2. Grubbing is to be limited on streambanks to the area required for the construction of abutments and for adjacent backfills to reach slope stability.
- B3. Excavations are to be conducted in such a manner as to keep the work area separated from the flowing stream.
- B4. Cofferdams are to be used to separate the entire work area from the flowing stream. Cofferdams are to be constructed of sandbags faced with plastic, sheet piling or material specified in the Water Approval. Earth fill, which causes siltation during removal, is not to be used.
- B5. Excavation of the bed or banks of a watercourse outside the cofferdam limits is not permitted.
- B6. Cofferdams are to have sufficient freeboard.
- B7. No excavation is to take place inside the cofferdam until the cofferdam is completely closed.
- B8. Unless previously approved, not more than 1/3 of the stream width is to be blocked at any one time during construction.
- B9. Care is to be taken during the placement and removal of cofferdams to minimize and prevent cofferdam material from washing into the stream.
- B10. Protection is to be provided to assure that no fresh concrete, lime, or cement is allowed to enter a watercourse.
- B11. Lumber treated with creosote is to be stored and air dried for a minimum of six months prior to use in or near the water.

- B12. All machine work is to be carried out from the watercourse banks unless otherwise stipulated by the Nova Scotia Department of the Environment. The construction or maintenance of piers in watercourses will be subject to site specific terms and conditions of the Water Approval.
- B13. Any silt laden water pumped from work areas within cofferdams, is to be directed to heavily vegetated areas, settling ponds or other treatment devices before it is allowed to re-enter any watercourse.
- B14. The Nova Scotia Department of the Environment "Guidelines for the Application and Removal of Structural Steel Protective Coatings are to be adhered to during maintenance or construction activities.





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## **NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)**

### **Culverts**

The following applies to culvert construction or maintenance.

- C1. The exemption under Section 5(1)(d) of the *Activities Designation Regulations* applies to the installation of a culvert during the period June 1 to September 30 only. Installation of a culvert outside this time frame will require formal approval and will require approval from the Department of Fisheries and Oceans. Installation of a culvert inside this time frame must be preceded with the submission of a Notification of Culvert Installation form at the designated Regional Office, Nova Scotia Department of the Environment.
- C2. The exemption applies to a single culvert installation with the following maximum dimensions:
  - a) 1.8 metres (6 feet) in diameter in the case of a pipe culvert;
  - b) 3.0 metres (10 feet) in span in the case of an arch or open bottom box culvert;
  - c) 18.3 metres (60 feet) in length in all cases.
- C3. Whenever possible, culverts shall be installed during periods of low flow. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- C4. The size of the culvert should be based on a minimum of 1:25 year estimated storm flows for forest roads and on a minimum of 1:100 year estimated storm flows for all other permanent installations.
- C5. The culvert is to be aligned with the stream.
- C6. Where fish passage is required, the maximum slope of the culvert is not to exceed 0.5%.
- C7. The stream is not to be disturbed outside the area to be covered by the culvert and rock apron. Depending on the size of culvert, the bottom of the culvert should be set from 75 mm to 150 mm (3 inches to 6 inches) below the stream bed. The bottom of a 450 mm (18 inch) culvert should be about 75 mm (3 inches) below the stream bed and a 1200 mm (48 inch) culvert about 150 mm (6 inches) below the stream bed.
- C8. If two or more culverts are to be set side by side, only one needs to be set below the stream bottom. The culverts are to be placed a minimum of one meter apart. The space

between the culverts is to be adequately compacted to prevent washout.

- C9. Culvert pipe should be set on a firm level bottom, preferably on a bed of gravel. If the stream channel contains rocks larger than 150 mm to 200 mm (6 to 8 inches) in diameter, the rocks are to be removed.
- C10. The road fill at each end of a culvert must be adequately protected from erosion by applying rock or other non-erodible materials to the top of the road bank. All materials are to be placed on a good footing to prevent collapse.
- C11. When more than one length of corrugated steel culvert is required the culverts are to be connected with couplings provided by the manufacturer.
- C12. The stream bottom and banks at the outlet of culverts are to be protected from scour by the water that flows through the culvert. If rock is not naturally present, rock protection is to be placed on the stream banks and the stream bottom for a specified distance downstream of culverts. The rock is to be a minimum of 150mm (6 inches) in diameter and be placed at the culvert outlet for the distances indicated in the following table. The rock must be non-ore bearing and non-toxic to aquatic life.

#### Culvert Size-Length of Rock Protection

| Culvert Size           | Length of Rock Protection |
|------------------------|---------------------------|
| 450 mm (18 inch) dia.  | 2.1 m (7 feet)            |
| 600 mm (24 inch) dia.  | 2.7 m (9 feet)            |
| 760 mm (30 inch) dia.  | 3.3 m (11 feet)           |
| 900 mm (36 inch) dia.  | 4.0 m (13 feet)           |
| 1200 mm (48 inch) dia. | 5.5 m (18 feet)           |

- C13. All excavated material and construction debris shall be disposed of away from the stream so that rain or high flow conditions will not return the debris to the stream.
- C14. Water control is to be accomplished using one of the following methods:
  - a) Installing the new culvert beside the watercourse and diverting the stream flow into the culvert following completion of the installation.
  - b) Diverting the watercourse, temporarily, through a diversionary channel.
  - c) Pumping the stream flow around the installation.
- C15. Excavation of diversionary channels is to be carried out in the dry from the downstream end. Diversionary channels constructed in erodible or silt-forming materials are to be stabilized with protective rock, plastic sheeting, or other approved materials before any flow is diverted.
- C16. The following uniformly-graded, stone-riprap material is to be used for embankment

protection unless alternate materials have been approved by the Nova Scotia Department of the Environment.

Class 1

Local velocity up to  
3 m per second  
(10 feet per second)

At least 70% of the riprap shall be between 200mm and 450mm (8 inches and 18 inches).

Class 2

Local velocity up to  
4 m per second  
(13 feet per second)

At least 70% of the riprap shall be between 300mm and 760mm (12 inches and 30 inches).

Class 3

Local velocity up to  
4.5 m per second  
(15 feet per second)

At least 70% of the riprap shall be between 500mm and 1200mm (20 inches and 48 inches).

C17. Culverts are to be installed prior to grubbing.

C18. During construction, temporary access roads and working areas around the site must be adequately surfaced with clean gravel and maintained to prevent siltation of the watercourse.



Department of  
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## NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)

### Dams

The following applies to dam construction or maintenance.

- D1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- D2. All dams require release of a maintenance flow or fish passage designed in accordance with the Department of Fisheries and Oceans, unless the applicant receives written permission, to construct the dam without a maintenance flow or fish passage, from the Department of Fisheries and Oceans.
- D3. All dams greater than 1.5 metres (5 feet) in height are to be designed by a registered professional engineer.
- D4. Any materials used in the construction of the dam are to be clean, non-ore-bearing and non-toxic to aquatic life. Protection is to be provided to assure that no excess fresh concrete, lime or cement is allowed to enter the watercourse.
- D5. Where dams are constructed across a watercourse, fill material is not to be excavated from riparian (stream side) areas.
- D6. For all dams not capable of being safely overtopped by flood water or wind generated waves, the minimum acceptable freeboard is 0.5 metre (1.6 feet).
- D7. All dams not capable of being safely overtopped are to incorporate a spillway designed to pass the minimum flood discharge, as determined below unless it is demonstrated in writing by a registered professional engineer that lesser spillway capacity is adequate and no risk to human life is thereby created.
- (i) freeboard less than one metre:  
 $Q = 6.93 A^{0.75}$  (Q in m<sup>3</sup>/s and A in km<sup>2</sup>)  
 $Q = 500 A^{0.75}$  (Q in cfs and A in mi<sup>2</sup>)
  - (ii) freeboard greater than one metre:  
 $Q = 3.465 A^{0.75}$  (Q in m<sup>3</sup>/s and A in km<sup>2</sup>)  
 $Q = 250 A^{0.75}$  (Q in cfs and A in mi<sup>2</sup>)

- D8. Trees and slash are to be removed from the area to be flooded when creating an impoundment. Trees are to be cut 100mm (4 inches) from the ground and the stumps are to remain.
- D9. Two-thirds of the prevailing flow is to be maintained during construction and filling.
- D10. The continuous maintenance flow requirements specified in the Water Approval are to be maintained downstream of the dam.



Nova Scotia

Department of  
the Environment**NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)****Diversion of a Watercourse:**

- DW1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- DW2. The original channel is to be left untouched until the diversion channel has been completed and approved by the Nova Scotia Department of the Environment.
- DW3. Excavation is to be carried out in the dry from the downstream end.
- DW4. The ends of the original channel are to be closed off with non-porous and non-erodible materials once the diversion channel has been approved.
- DW5. The diversion channel is to physically resemble the original channel in cross-section.
- DW6. If a tributary stream enters the existing channel along the reach to be bypassed by the diversion channel, provision is to be made to connect the tributary to the diversion channel by an appropriately designed channel.
- DW7. If the original channel will no longer be used, it is to be backfilled with non-porous and non-erodible material throughout the full length of the diverted reach, once flow has been established in the diversion channel.
- DW8. The bottom of the new channel is to be deeper in the centre along the straight sections and on the outside banks in the meanders.
- DW9. To prevent erosion, all diversion channels shall be stabilized by riprap, or in the case of temporary diversions, plastic lining may be used.

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the Environment

## **NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)**

### **Dredging:**

- DR1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas. The use of a silt screen (silt curtain) may be required.
- DR2. Dredging is generally not permitted except in cases where the dredge area is small and does not support fish habitat. Written permission from the Department of Fisheries and Oceans is required in all cases.
- DR3. Dredged material is to be disposed of away from the watercourse in an area that will prevent re-entry of the material into the watercourse and in an area acceptable to the Nova Scotia Department of the Environment.
- DR4. Machinery is not permitted to enter the watercourse.
- DR5. The banks of the watercourse are to be satisfactorily rehabilitated if damaged during the dredging activity.

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Department of  
the Environment**NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)****Fords**

- F1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- F2. Temporary fords are only permitted during the period June 1 to September 30 unless otherwise specified in the Water Approval.
- F3. Temporary fords are to be located where the stream bottom is firm enough to carry the load and the majority of the stone material is in excess of 100mm (4 inches) in diameter.
- F4. Any materials placed in the stream to improve the crossing site are to be clean, non-ore-bearing and non-toxic to aquatic life. A minimum water depth of 200mm (8 inches) at the crossing site is to be maintained where stream flows permit.
- F5. Temporary fords are to be restricted to a single location and at right angles to the watercourse channel. The bed of the channel is not to be used for travel parallel to the banks of the watercourse.
- F6. a) The ford shall have a maximum width of 1.5 times the equipment width.  
b) The stream bank approaches are to be lowered to at least 3 to 1 slope.  
c) To prevent silt tracking, 75mm (3 inch stone), corduroy or brushmats are to be used to stabilize both approaches to the ford.  
d) The banks and wheel impressions are to be permanently stabilized upon project completion.
- F7. Equipment required to temporarily ford a watercourse is to be mechanically sound, having no leaking fuel tanks or hydraulic connections.
- F8. Equipment activity within the wetted perimeter of the stream is to be kept to the absolute minimum.
- F9. Parking of equipment in the watercourse is not permitted.
- F10. If equipment becomes stuck within the watercourse or on its banks, the equipment is to be winched or pulled out. Shovelling and excessive spinning are not permitted.



Department of  
the Environment

## **NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)**

### **Pipelines**

The following applies to pipeline or cable installation or maintenance under the bed of a watercourse.

- P1. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- P2. During construction, streambanks are to be graded so that ground elevation gradually decreases from the top of the bank to the edge of the stream.
- P3. No heavy equipment is to be used within 30 metres (100 feet) of a stream prior to grubbing. Within the area, large trees and shrubs must be cleared manually.
- P4. Grubbing of the area within 30 metres (100 feet) of the stream is permitted only when actual stream crossing work is to begin.
- P5. Grubbing may not be carried out beyond a 15 metre (50 feet) strip upstream and downstream of the crossing centreline (a total width of 30 metres). As the pipeline or cable work proceeds, all soil areas laid bare must be seeded and/or vegetated and the stream banks restored.
- P6. Pipe installed in a trench in an unconsolidated bed is to be set two metres (6.5 feet) below the stream bed grade. If solid rock is encountered, which requires blasting, the pipe may be set at 1 metre (3.25 feet) below the stream grade. Exceptions to this will be specified in the Terms and Conditions of the Water Approval.
- P7. Any surplus material excavated from the stream bed or banks during trenching operations must be disposed of away from the stream.
- P8. Where rock was removed, gravel fill or clean, non ore-bearing and non-toxic quarried rock material is to be used as protective material to be placed on top of the filled trench to prevent any possible erosion of materials beneath.
- P9. In wide stream crossings the pipe must be ballasted to prevent it from floating.

- P10. Appropriate environmental mitigation measures may vary in accordance with the trenching techniques employed and therefore crossings may be reviewed by regulatory and advisory agencies on a specific technique or case basis. Methods and detailed drawings will be required.
- P11. Where a major pipeline crosses a watercourse on supports or piers built especially to carry it, the Watercourse Alteration Specifications for bridges will also apply.
- P12. A plan depicting erosion and sediment control methods will be required.
- P13. Streambanks at pipeline or cable crossings shall be rehabilitated and stabilized with riprap, geotextile or vegetation, or combination thereof, as soon as excavations are backfilled.



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Department of  
the Environment**NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)****Ponds**

- Po1. Instream ponds are not permitted unless the watercourse is relatively small and does not support fish habitat. Specifications for the installation of instream ponds will be indicated in the Water Approval and are subject to approval from the Department of Fisheries and Oceans.
- Po2. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- Po3. The minimum distance from the pond to the watercourse is to be 15 metres (50 feet) unless approved by an Administrator.
- Po4. The site of the pond is to be chosen such that the natural drainage to the pond does not include known sources of pollution.
- Po5. The maximum size of the inlet and outlet pipes is 250mm (ten inches).
- Po6. The maximum water diversion from the watercourse is not permitted to exceed 1/3 of the low flow for the site as computed by the formula:
- $$Q = 0.05 \text{ cubic feet per second per square mile} \times A$$
- where;
- Q = the water withdrawal rate in cubic feet per second and
- A = the catchment area of the watercourse in square miles.
- Po7. The inlet and outlet pipes of the pond are to be screened as follows:
- i) inlet pipe - screened on stream side with maximum inside screen mesh opening of ten millimetres. An outside screen of large mesh or a trash rack must protect the inner screen.
  - ii) outlet pipe - screened on pond side.
- Po8. The ends of the pipes must be protected from the action of the stream by carefully placing large stone riprap along the bank around the ends of the pipes but not protruding into the watercourse.
- Po9. Trees and brush are to be removed and disposed of away from the site of the proposed pond.

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Department of  
the Environment**NOVA SCOTIA WATERCOURSE ALTERATION SPECIFICATIONS (1997)****Wharves**

- W1. An Approval for the construction of all wharves must be obtained from the Department of Natural Resources prior to any construction.
- W2. All work operations are to be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.
- W3. The maximum length of the wharf is not to exceed 15 metres (50 feet).
- W4. Wharves are to be built on cribs or poles, or a crib or poles may be used to anchor a floating dock.
- W5. For wharves built on 2 or more cribs, the first crib is to be located a minimum of 3 metres (10 feet) from shore, or extend into a lake or river below the ordinary high water mark to allow for near shore circulation.
- W6. Each crib is not to exceed 3.6 metres (12 feet) in length and subsequent spans are to be a minimum of 3 metres (10 feet) in length.
- W7. For wharves built on poles, a minimum distance of 1.2 metres (4 feet) is to be maintained between poles.
- W8. If a single crib or gabion is used to anchor a floating dock, the crib or gabion is to be placed at the shore line and extend into the water a maximum horizontal distance of 2 metres (6 feet).
- W9. Wharves shall not obstruct navigation or the flow of water.
- W10. Lumber treated with creosote is to be stored and air dried for a minimum of six months prior to use in or near the water.



## Appendix C

## Standard Rates

**1. OVERHAUL RATES.**

| Haul, m                                                                         | \$ per m <sup>3</sup> |
|---------------------------------------------------------------------------------|-----------------------|
| 300 - 599                                                                       | 0.50                  |
| 600 - 899                                                                       | 0.61                  |
| 900 - 1199                                                                      | 0.72                  |
| 1200 - 1499                                                                     | 1.01                  |
| 1500 - 1799                                                                     | 1.18                  |
| 1800 - 3199                                                                     | 1.59                  |
| 3200 - 4799                                                                     | 1.98                  |
| 4800 - 6399                                                                     | 2.37                  |
| For each increment of 1600 m, the rate increases by \$0.39 per m <sup>3</sup> . |                       |

**2. GRAVEL IN STOCKPILE.**

The Contractor is advised that the current rate of \$3.02 per tonne will apply to Gravel in Stockpile as referred to in Division 3 Sections 2, 3, and 4, and Division 4 Section 4.

**3. PILOT VEHICLE.**

Circumstances may arise in certain signing procedures that warrant the use of a Pilot Vehicle by the Contractor. When the use of a Pilot Vehicle is approved by the Engineer, the rate to be paid for the Pilot Vehicle including the operator and all operating costs, will be \$20.50 per hour.

**4. COLD WEATHER CONCRETE.**

**4.1 Special Protection.** \$4.84 per cubic metre of concrete placed.

**4.2 Special Protection with Insulation.** \$24.40 per cubic metre of concrete placed.

**4.3 Complete Housing with Heat.** \$49.60 per cubic metre of concrete placed.

## Appendix C

## Standard Rates

## 5. CUBIC METRE KILOMETRE RATE.

| Km | \$/m <sup>3</sup> | Km | \$/m <sup>3</sup> | Km | \$/m <sup>3</sup> | Km | \$/m <sup>3</sup> |
|----|-------------------|----|-------------------|----|-------------------|----|-------------------|
| 1  | 1.33              | 21 | 6.31              | 41 | 10.54             | 61 | 11.67             |
| 2  | 1.60              | 22 | 6.54              | 42 | 10.55             | 62 | 11.77             |
| 3  | 1.83              | 23 | 6.78              | 43 | 10.56             | 63 | 11.88             |
| 4  | 2.10              | 24 | 7.00              | 44 | 10.57             | 64 | 11.98             |
| 5  | 2.35              | 25 | 7.23              | 45 | 10.58             | 65 | 12.11             |
| 6  | 2.60              | 26 | 7.47              | 46 | 10.59             | 66 | 12.21             |
| 7  | 2.86              | 27 | 7.71              | 47 | 10.61             | 67 | 12.32             |
| 8  | 3.11              | 28 | 7.93              | 48 | 10.62             | 68 | 12.42             |
| 9  | 3.37              | 29 | 8.16              | 49 | 10.63             | 69 | 12.55             |
| 10 | 3.62              | 30 | 8.39              | 50 | 10.64             | 70 | 12.64             |
| 11 | 3.89              | 31 | 8.62              | 51 | 10.65             | 71 | 12.77             |
| 12 | 4.13              | 32 | 8.85              | 52 | 10.66             | 72 | 12.87             |
| 13 | 4.39              | 33 | 9.07              | 53 | 10.78             | 73 | 12.98             |
| 14 | 4.64              | 34 | 9.26              | 54 | 10.89             | 74 | 13.09             |
| 15 | 4.88              | 35 | 9.48              | 55 | 10.99             | 75 | 13.20             |
| 16 | 5.15              | 36 | 9.69              | 56 | 11.11             | 76 | 13.30             |
| 17 | 5.38              | 37 | 9.90              | 57 | 11.21             | 77 | 13.43             |
| 18 | 5.63              | 38 | 10.10             | 58 | 11.33             | 78 | 13.52             |
| 19 | 5.83              | 39 | 10.31             | 59 | 11.45             | 79 | 13.64             |
| 20 | 6.08              | 40 | 10.53             | 60 | 11.54             | 80 | 13.76             |



## Appendix C

## Standard Rates

**6. TRUCK RATES.**

For trucks operating with full loads, the rates will be increased by 10% for specific rock hauling operations involving quarried rock or uncrushed field stone larger than 0.03 cubic metre.

**6.1 Tonne Kilometre Rates**

For trucks hauling asphalt add 63 cents per tonne.

| Km | \$/Tonne | Km | \$/Tonne | Km | \$/Tonne | Km                                      | \$/Tonne |
|----|----------|----|----------|----|----------|-----------------------------------------|----------|
| 1  | 0.84     | 28 | 5.05     | 55 | 6.76     | 82                                      | 8.43     |
| 2  | 1.00     | 29 | 5.21     | 56 | 6.84     | 83                                      | 8.51     |
| 3  | 1.14     | 30 | 5.37     | 57 | 6.89     | 84                                      | 8.57     |
| 4  | 1.32     | 31 | 5.52     | 58 | 6.96     | 85                                      | 8.62     |
| 5  | 1.47     | 32 | 5.69     | 59 | 7.01     | 86                                      | 8.68     |
| 6  | 1.63     | 33 | 5.79     | 60 | 7.08     | 87                                      | 8.76     |
| 7  | 1.77     | 34 | 5.90     | 61 | 7.14     | 88                                      | 8.82     |
| 8  | 1.94     | 35 | 6.02     | 62 | 7.20     | 89                                      | 8.87     |
| 9  | 2.08     | 36 | 6.12     | 63 | 7.26     | 90                                      | 8.94     |
| 10 | 2.26     | 37 | 6.23     | 64 | 7.33     | 91                                      | 9.00     |
| 11 | 2.40     | 38 | 6.35     | 65 | 7.39     | 92                                      | 9.06     |
| 12 | 2.57     | 39 | 6.46     | 66 | 7.46     | 93                                      | 9.12     |
| 13 | 2.71     | 40 | 6.57     | 67 | 7.51     | 94                                      | 9.19     |
| 14 | 2.87     | 41 | 6.58     | 68 | 7.56     | 95                                      | 9.24     |
| 15 | 3.03     | 42 | 6.59     | 69 | 7.64     | 96                                      | 9.29     |
| 16 | 3.17     | 43 | 6.60     | 70 | 7.71     | 97                                      | 9.39     |
| 17 | 3.35     | 44 | 6.63     | 71 | 7.76     | 98                                      | 9.44     |
| 18 | 3.50     | 45 | 6.64     | 72 | 7.81     | 99                                      | 9.49     |
| 19 | 3.66     | 46 | 6.65     | 73 | 7.88     | 100                                     | 9.54     |
| 20 | 3.80     | 47 | 6.66     | 74 | 7.94     | +6.20 cents per<br>Tonne over 100<br>km |          |
| 21 | 3.97     | 48 | 6.67     | 75 | 8.01     |                                         |          |
| 22 | 4.12     | 49 | 6.68     | 76 | 8.07     |                                         |          |
| 23 | 4.27     | 50 | 6.69     | 77 | 8.13     |                                         |          |
| 24 | 4.43     | 51 | 6.70     | 78 | 8.19     |                                         |          |
| 25 | 4.60     | 52 | 6.71     | 79 | 8.25     |                                         |          |
| 26 | 4.76     | 53 | 6.73     | 80 | 8.33     |                                         |          |
| 27 | 4.89     | 54 | 6.75     | 81 | 8.38     |                                         |          |

Standard RatesAppendix C**6.2 Hourly Rate.**

For all truck/trailer configurations, registered to their maximum allowable weight, payment for all work compensated on an hourly basis shall be at a rate of \$13.00 per axle per hour.

**6.3 Truck Rates - Service Truck.****6.3.1 Truck Rate - Service Truck - Includes Driver.**

To be used when other rates do not apply, e.g. partial loads, intermittent use.

Truck one (1) tonne & under...\$11.48 per hour

Trucks over one (1) tonne... Min. Hourly rate (3 cu.Metre-\$19.26)

**6.3.2 Truck Rates - Service Truck- Without Driver.**

Truck one (1) tonne & Under...\$4.69 per hour

## Appendix D

## Value Engineering Alternate (VEA)

## VALUE ENGINEERING ALTERNATE (VEA)

## 1.0 General

A Value Engineering Alternate (VEA) is an alternate design or modification(s) to a tendered design where a construction cost saving in excess of \$50,000 can be achieved, without compromising the integrity and quality of the project. The Contractor has the option of submitting only one VEA for Preliminary Design Review, either with the bid or up to ten working days after the tender is awarded. The VEA will not be considered when awarding the tender. The VEA may be accepted or rejected by the Department at its sole discretion. The proposing of any design does not place the Department under any obligation to accept the design. Net construction savings will be shared equally between the Contractor and the Department. Minimum overall savings will be identified, confirmed and fixed prior to the Department giving approval to a VEA.

Changes which require different right-of-way limits or proposals involving work outside the scope of the tendered contract will not be considered as an acceptable VEA.

The VEA Review will be divided into three stages. Where a VEA is proposed, the Contractor has the option of submitting an informal Concept Submission, in which only a general description of the work is required. Should the Concept Submission be acceptable the Contractor will then submit a Preliminary Design, which requires a review by the Department to ensure it meets the requirements as specified. If the Preliminary Design review is satisfactory, the Contractor shall complete a Detailed Design as specified.

The Contractor shall be responsible for costs associated with reviewing and evaluating the VEA as follows:

- Concept Submission Review (optional) - There will be no cost associated with this step in the procedure.
- Preliminary Design Review - At the time that the preliminary design is submitted, the Contractor shall provide a certified cheque in the amount of \$2,000.00.
- Detailed Design Review - At the detailed design review stage, the Contractor shall provide a certified cheque in the amount of \$8,000.00.

The costs of the VEA, listed above, will be returned to the Contractor after final acceptance of his VEA. Should the VEA be disapproved, at any stage, all monies submitted will be retained by the Department.

The VEA proposal does not relieve the Contractor of any other contractual obligations.

## 2.0 Preliminary Design Review

To enable the Department to assess a VEA, the following minimum information shall be provided at the preliminary design review stage:

- Identification of the Contractor's Design Engineers including past project experience and resumes of designated individuals. The Design Engineer of Record must be registered in the Province of Nova Scotia and meet any acceptance criteria the Department may require depending on the nature of the VEA submitted.
- Identification of the Contractor's relevant experience including similar projects.
- Information specific to the VEA, in compliance with overall design criteria, in written and general arrangement drawing form, as follows:
  - Finished roadway elevations on, under and/or through the structure as applicable.
  - Span arrangements.
  - Foundation types.
  - Sections showing superstructure members including deck and curb type and number, type and size of girders.
  - Pier section showing pier type and details of pier foundation.
  - Abutment elevation sections showing abutment type and abutment foundation.
  - General description of construction erection procedure.
  - General description of bearings, deck joints and briderail proposed.
  - General description of wingwall type and geometry.
  - General description of materials to be used and finish treatments.
- Design information to a level that displays a workable solution meeting project requirements.
- Realistic work schedule, including detail design and review stages, compliance with environmental restrictions and other regulatory agencies, and the effect on the project schedule completion dates.
- A detailed cost breakdown similar to the Department's tendered design including unchanged and modified items/prices from the tendered design and new items/prices pertaining to the VEA.
- Life cycle cost analysis for anticipated fifty year life span.

The VEA submission shall include a VEA cover page and VEA contents page as shown later in this document.

Submissions shall be complete, as described above, at the preliminary design review stage enabling the Department to conduct a full assessment for

**Appendix D****Value Engineering Alternate (VAE)**

equivalencies, including, but not limited to:

- functionality
- serviceability
- durability
- maintainability
- cost
- aesthetics

If a submission is not complete it may be grounds for immediate rejection.

The Department and Contractor shall agree on the overall net savings as a result of the VEA and jointly sign a 'VEA Agreement', as shown later in this document, prior to approval being given.

Upon receiving the VEA or the award of the tender, whichever occurs last, the Department will require five (5) working days to complete the preliminary design review and inform the Contractor in writing whether the preliminary design has been approved or rejected. If approved the Contractor will submit a detailed design in a time frame commensurate with the level of complexity of the VEA. If rejected, the tendered design will be constructed as specified.

**3.0 Detailed Design Review**

The Contractor shall be responsible for completing the final detailed design. The design shall be prepared and stamped by a Professional Engineer, accepted under the Preliminary Design review and registered in the Province of Nova Scotia, and shall be complete in all respects, including all drawings and other information required to build the structure. Upon receiving the final complete set of design drawings, the Department will require (20) working days for reviewing the design and drawings. The Contractor may submit the final design drawings in two stages: a) one for the substructure and b) one for the superstructure in which case the Department will require ten (10) working days to review each submission but a minimum of twenty (20) working days in total. The submission for the substructure shall include the superstructure loads. The Department assumes no responsibility for the correctness or adequacy of the design as a result of this review.

The detailed design requirements are as follows:

- The design shall comply with the requirements of the current edition of CAN/CSA-S6. The requirements of this code may be supplemented with other design codes subject to the overall level of safety and loadings required by CAN/CSA-S6 being maintained and the approval of the Department.
- The minimum requirements of the roadway design drawings included with the tender shall be met including but not limited to; roadway alignment, clear

roadway width, and environmental mitigation works. Any adjustment to the alignment including all associated works shall be at the Contractor's expense.

- Navigable Waters Protection Act (NWP) approval for the tendered design will be the responsibility of the Department. Any additional NWP approvals for the VEA will be the responsibility of the Contractor.
- All Department of Environment (DOE) and Department of Fisheries (DFO) approvals and permits for the tendered design will be the responsibility of the Department. Any additional DOE and DFO or other regulatory approvals and permits for the alternate will be the responsibility of the Contractor.
- Bridge wearing surface and bridge accessories (bridgerail, deck joints, deck and abutment drains, utility ducts, curbs, pier nose plates, etc.) shall be the same or equivalent to those of the tendered design.
- Only new materials shall be permanently used in the VEA.
- The Department's construction and maintenance standards shall be used except as modified and/or supplemented by the Specifications pertaining specifically to the VEA.

**4.0 Other Requirements**

The Contractor shall be responsible for making any adjustments or alterations at his own cost, for whatever cause, to his submission or design to make the option congruent with the specified requirements. Any portion of construction cannot commence until the design has been approved for that portion of the work.

The Department shall be responsible for contract administration services during construction. The Contractor shall make provision for the involvement of his Design Engineer as Engineer of Record as necessary. If the VEA involves inspection work which is unfamiliar or beyond the capabilities of the Department's staff and a specialist is required, all costs for the additional inspection will be the responsibility of the Contractor.

The cost of the work, as determined by the approved VEA, will be paid on the normal progress payment basis.

The Contractor's 50/50 share of the cost savings, as a result of the VEA and as agreed to prior to the VEA approval, will be paid as a lump sum separate item on the final progress payment.

The Department expressly reserves the right to adopt a VEA for general use in future projects administered by the Department when it determines the VEA is

Appendix D

Value Engineering Alternate (VAE)

suitable for application to other projects without obligation or compensation of any kind to the Contractor.



Appendix D

Value Engineering Alternate (VEA)

# VALUE ENGINEERING ALTERNATE (VEA)

**Tender No:**

**Project No:**

**Project Description:**

**Nature of VEA:**

Appendix D

Value Engineering Alternate (VAE)

## Value Engineering Alternate Contents

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2. Contractor's relevant experience
3. Finished roadway elevations
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7. Pier section
8. Abutment elevation sections
9. Construction erection procedure
10. Bearings, deck joints and bridgerail
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12. Materials used and finish treatments
13. Design calculations
14. Work schedule
15. Detailed cost breakdown
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Submitted by:

February 1, 1997



## Appendix E

## Glossary of Terms

## GLOSSARY OF TERMS

**Alkali Aggregate Reactivity (AAR):** The reaction of cement alkalis with some forms of silica in fine or coarse aggregates causing disruptive expansion and cracking of concrete.

**Anionic:** A negatively charged ion in a solution; that portion of a compound which when dissolved (usually in water) tends to move toward the anode under the influence of a direct current.

**Asphalt Emulsion:** An emulsion of asphalt cement and water which contains a small amount of a surface active agent (emulsifier). Emulsified droplets of asphalt may be of either anionic (negative charge) or cationic (positive charge) type, depending on the surfactant used.

**Asphalt Emulsion Prime:** An application of a low viscosity asphalt emulsion to an absorbent surface or granular base, in preparation for an asphalt surface course.

**Base:** Granular materials placed immediately below the pavement.

**Cationic:** A positively charged ion in a solution; that portion of a compound which when dissolved (usually in water) tends to move toward the cathode under the influence of a direct current.

**Cementing Materials:** (Portland Cement Concrete) A combination of Portland cement and supplementary cementing materials such as fly ash, blast furnace slag or silica fume.

**Chipping Hammers:** Electric or pneumatic (air operated) impact hammer tools available with a variety of striking points designed to remove brittle material. Chipping hammers shall not exceed 7 kg.

**Cold Weather:** Those conditions when the air temperature is at or below 5°C. It is also considered to exist when the air temperature is at or is likely to fall below 5°C within 24 hours after concrete placement. Temperature refers to shade temperature.

**Culverts:** All waterway structures not defined as bridges and having a least dimension of opening of not less than 300 mm.

**Curing:** (Portland Cement Concrete) Process of maintaining adequate moisture in concrete for a period of time necessary to develop the desired properties of the concrete.

**D-Cracking:** (Portland Cement Concrete Pavement) A series of closely-spaced, fine, crescent shaped cracks in the concrete surface usually paralleling a joint or major crack and usually curving across slab corners. For 'D' cracks the crescent is concave in relation to the slab corners or joints.

**Deck:** That portion of the bridge which directly supports vehicle and pedestrian traffic and includes slab, curbs, gutters, sidewalks and parapets.

**Dowel Bars:** Smooth round steel bars placed across transverse joints usually at a spacing of 300 mm. These bars provide load transfer while permitting a joint to open and close.

**EPWS:** End Product Warranty Specification.

**Fly Ash:** Finely divided residue that results from the combustion of pulverized coal.

**Hot Weather:** Those conditions when the air temperature is at or above 27°C. It is also considered to exist when the air temperature is at or is likely to rise above 27°C within 24 hours. Temperature refers to shade temperature.

**Isolation and Expansion Joints:** Joints placed to allow movement of the pavement without damaging adjacent pavements, intersecting streets, drainage structures or other fixed objects.

**Jack Hammers:** Electric or pneumatic (air operated) impact hammer tools available with a variety of striking points designed to demolish or remove brittle material. Jack hammers shall be 14.0 kg maximum mass.

**Layer (Reinforcing Steel):** Two or more reinforcing bars placed in a plane parallel to a concrete face.

**Load Transfer:** (Portland Cement Concrete Pavements) Is the effective transfer of traffic loads from one side of the joint to the other. Load transfer across joints is developed either by aggregate interlock or by using dowel bars.

**Longitudinal Joints:** (Portland Cement Concrete Pavements) Joints parallel to the pavement centerline that control cracking.

**Mat :** (Reinforcing Steel) Transverse and longitudinal layers of reinforcing steel tied together.

**Non-Structural Concrete:** Concrete that is non-

## Appendix E

## Glossary of Terms

reinforced, and used in components that are not designed to withstand heavy loads or that is used as fill material in excavations.

**Portland Cement:** The product obtained by pulverizing clinker consisting essentially of hydraulic calcium silicates to which calcium sulfate, limestone, water and processing additions may be added at the option of the Manufacturer.

**Polymer:** A large molecule made by the repetitive combination of a large number of simpler, identical units called monomers.

**Ready Mixed Concrete:** Concrete that is completely batched at the plant and completely mixed in a truck at the plant, or while in transit.

**Reclaimed Asphalt Pavement (RAP):** An asphalt pavement that has been scarified and pulverized or crushed. No attempt is made to control gradation, except for maximum particle size. The resulting asphalt aggregate mix may be recycled.

**Recycle:** The reuse (usually after processing) of a material that has already served its first intended purpose.

**Rehabilitation:** Any modification, alteration or improvement to a structure or its components which is designed to correct defects or deficiencies.

**Roller Compacted Concrete (RCC):** RCC is a zero-slump concrete mixture that is mixed in a pug mill or stationary mixer, placed and roller compacted.

**Silica Fume:** Finely divided residue resulting from the production of silicon or silicon containing alloys.

**Single Chip Seal:** A wearing surface consisting of a uniform application of a rapid setting (RS or CRS) or medium setting (MS or CMS) or high float asphalt emulsion to a prepared surface followed by a uniform application of cover aggregate, which is then rolled.

**Stationary Mixer:** A non-mobile mixer installed at a central mix plant for the purpose of mixing concrete.

**Straight Edge:** The straight edge shall be commercially fabricated metal for the intended purpose and be at least 3 m long. The straight edge shall be free from defects and kept straight and true at all times.

**Subbase:** Granular materials placed immediately below

the base and above the subgrade.

**Subgrade:** That portion of the roadbed upon which the subbase (or base in the case where subbase granulars are not used) is to be placed.

**Substructure:** All that part of the structure below the bridge seats or below the springing line of arches. Back walls and parapets of abutments and wing walls shall be considered as part of the substructure.

**Superstructure:** All that part of the structure above the bridge seats or above the springing lines of arches, including the flooring, and not included in the substructure.

**Surface Treatment:** A chip seal applied to a prepared consolidated gravel, crushed stone, water bound macadam, stabilized soil or similar base.

**Tack Coat:** A spray application of asphalt emulsion to an existing asphalt or Portland Cement concrete surface prior to an asphalt overlay or patch to provide a bond between new and existing pavement layers.

**Tie Bar:** Deformed bar placed transverse to longitudinal joint to prevent individual slabs from separating.

**Tining:** Small grooves of specified dimension which are hand or machine made in the concrete surface in the transverse direction.

**Transverse Construction Joints:** (Asphalt Concrete Paving) Joints installed at the temporary end of a paving operation. Whenever possible, these joints should be installed at the location of a planned joint.

**Transverse Contraction Joints:** Joints that are constructed transverse to the centerline and spaced to control cracking from stresses caused by shrinkage, from moisture and thermal changes. Typically transverse contraction joints are oriented at right angles to the centerline and edge of the pavement lanes.

**Unshrinkable Backfill:** A mixture of aggregate, cement, water and fly ash (when desired) to create a controlled density, low strength, flowable material. Unshrinkable fill is self consolidating and rigid setting and may be substituted for compacted gravel for backfill and structural fills.

**WS:** Warranty Specification.